DESIGNS

FOR

AGRICULTURAL BUILDINGS,

INCLUDING

LABOURERS' COTTAGES,

FARM-HOUSES AND OUT-OFFICES,

CONVENIENTLY ARRANGED AROUND FOLD-YARDS, AND ADAPTED TO FARMS OF VARIOUS SIZES AND DESCRIPTIONS:

TO WHICH ARE PREFIXED,

An Essay on the Improvement of the Condition of Cottagers,

NECESSARY PRELIMINARY INFORMATION (ILLUSTRATED BY WOOD CUTS) FOR CONSTRUCTING AGRICULTURAL BUILDINGS,

AND EXPLANATIONS AND OBSERVATIONS ON THE SEVERAL DESIGNS;

TOGETHER WITH

AN IMPROVED FIELD GATE, AND STAND FOR A CORN RICK.

TO WHICH ARE ADDED,

PLANS AND REMARKS ON CATERHAM FARM YARD,

AS IT FORMERLY WAS; AND ALSO AS IT HAS BEEN IMPROVED.

BY THE LATE **CHARLES WAISTELL, Esq.**

CHAIRMAN OF THE COMMITTEE OF AGRICULTURE OF THE SOCIETY OF ARTS.

TWELVE VERY SUPERIORLY ENGRAVED COPPER PLATES OF PLANS, ELEVATIONS, ISOMETRICAL PERSPECTIVE VIEWS OF HOMESTEADS, &c. &c.

JOSEPH JOPLING, Architect, Editor,

MEMBER OF THE INSTITUTION OF CIVIL ENGINEERS, INVENTOR OF THE SEPTENARY SYSTEM OF GENERATING LINES BY SIMPLE CONTINUOUS MOTION, INSTRUMENTS FOR DRAWING CURVES, &c. &c.

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TO

PINDER SIMPSON, Esq.

FOR WHOM

THE AUTHOR

HAD GREAT RESPECT,

This Work,

ON THE IMPROVEMENT OF AGRICULTURAL BUILDINGS,

&c. &c. &c.

IS, WITH MUCH PLEASURE, INSCRIBED,

BY

THE EDITOR.

PREFACE BY THE EDITOR.

THE Author of this Work, the late Mr. CHARLES WAISTELL, was, for several years, a Chairman of the Committee of Agriculture of the Society of Arts. To this office he was unanimously elected at the recommendation of Dr. CHARLES TAYLOR, the late Secretary of that Society.

Mr. WAISTELL was also during his whole life more or less connected with Agricultural pursuits; and the subject of making "Designs for Agricultural Buildings," engaged his attention for a period of more than fifty years, during which time many of his plans were executed in various parts of the kingdom. On different occasions it appears to have been his intention to have published a Selection of his Designs, with the Hints and Observations which, from time to time, he had collected, for the improvement of "Labourers" and their "Cottages," as well as "Farm-houses and Out-Buildings;" but other pursuits requiring his immediate attention, they were as often laid aside. After he had retired from business, the "Agricultural Distress," which greatly occupied his mind, was the cause of further postponement. "When farmers cannot live," said he, "money cannot be spared to make improvements." However, more than two years ago he had selected the Designs, and arranged a considerable part of the Work for publication, when a serious and protracted indisposition, which terminated in his death, finally stopped its further progress by his own hand.

Mr. WAISTELL'S Manuscripts and Drawings were left to his nephew, the Editor, who trusts that this publication alone will prove an honourable monument to the memory of his uncle. He hopes, however, at no distant period, also to re-publish, with additions, his uncle's Tables and Observations on the Growth of Timber. When the papers came into the Editor's possession, he was neither a stranger to the work, nor to the writer's ideas, having frequently experienced the benefit of the information he communicated on this subject, when professionally engaged in designing homesteads; he had not, however, that intimate acquaintance with the whole of what his uncle had written, that now became necessary, in order to finish the work. He, therefore, determined to read over all the author's papers in reference to Agricultural Buildings. These were very numerous, and had been accumulating for so many years, and the subject so often left off and again resumed, that he found many important ideas had been omitted in the last arrangement; indeed, not unfrequently in writing on the same article at different times, it was quite evident that what had previously been written had been mislaid; thus, the same ideas were at different times differently expressed, and something contained in the first that was not in the last, and vice versa. During this research materials for the chapter on the improvement of the condition of cottagers, which had not hitherto been arranged, were collected.

On the plans that were selected, the names of the several conveniences were not written, as it was the intention of referring to them by letters; this method, however, from the trouble it would occasion, and the difficulty of remembering the name from the letter, has been substituted by the name of the place, neatly engraved in the different divisions of the plans. In order to get the names of the several parts, all the Author's plans were examined, and, by this means, a table was formed of the conveniences required in Agricultural Buildings: this led to the arrangement and observations on several parts that had not before been noticed, and this list or table was found extremely useful, in comparing

and completing the selected designs, as well as in writing the explanations; and it is considered it will not be less so to those who may have occasion to build, for it cannot be supposed, and indeed it is hardly possible, that a farmer who, perhaps, has his thoughts only once in his life particularly engaged on this subject, should be able to enumerate, at the time the plan is made, every convenience he may require, and his not being able to do so, frequently renders it necessary, in adding such conveniences as may have been overlooked, to place them in situations not the most desirable, and which might have been properly arranged, if they had been thought of before the commencement of the business.

The list of conveniences, which is divided into two parts, first, those more properly belonging to the farm-house and attached offices, and second, those belonging to the out-offices of farm-buildings, has been of equal service to the Editor since this work went to press, in his professional pursuits, both in designing alterations and additions for the improvement of several farm-buildings, as well as in designing new erections, to answer particular situations in local districts. On this as well as on former occasions, he also experienced the vast importance of having correct plans of existing conveniences, and ascertaining their particular condition, previously to proposing any alteration; and, in most cases, he has found that by transposing the uses of some of the old buildings, placing the new in proper situations, removing some insignificant parts, and forming comfortable fold-yards, much greater improvements could be effected than was anticipated. Plans of present buildings, with designs for alterations or additions being made, gentlemen, or their agents, by directing such erections as are immediately wanted, to be placed in reference to future requirements, might in a few years vastly improve, at, comparatively speaking, little expence, the whole of the buildings on their estates: without this, if a barn be required, it perhaps may, in reference to the future, and the most complete improvements the situation may be susceptible of, be put up where the stable,

or some other building, ought to be erected. There is certainly no other way to account for the very strange, and most inconvenient, irregularity in the farm-buildings; the homesteads being without commodious and comfortable fold-yards; and the dwelling-house being placed so frequently in the midst of the dung-hill, in all parts of the kingdom.

Many years ago, when the Author contemplated publishing, he intended to have added Extracts from Experiments and other Observations on the Strength of Timber, &c., by Emmerson, Buffon, &c. &c., but this idea he abandoned, and refers those who may be desirous of such information respecting that curious and useful subject, to the Encyclopedia Britannica, Nicholson's Architectural Dictionary, Barlow on the Strength of Timber, and Treadgold's Carpentry.

Although the Author had written explanations and observations on many of his designs, they had been so frequently altered, that none of them were found applicable to those he had selected; the Editor, however, believes that he has, in that part of the work, and in the descriptions of the various conveniences, embodied all the Author's ideas on this subject that he could collect. To avoid repetition, such observations on the arrangement or conveniences that have occurred in the explanation of previous designs, are omitted in the succeeding, and only the circumstances in which they differ pointed out. Had the Author lived to publish this Work himself, he would, perhaps, not have completed it exactly in the same way; but the Editor believes he has made no additions or alterations, which do not correspond with what were the sentiments of his uncle upon the subject.

24, SOMERSET STREET, PORTMAN SQUARE,
London, 7th November, 1826.

CONTENTS.

CHAP. IV.

CHAP. V.

ENGRAVINGS, EXPLANATIONS, AND OBSERVATIONS.

DESIGNS

FOR

AGRICULTURAL BUILDINGS,

&c. &c.

INTRODUCTORY OBSERVATIONS.

BUILDING is ranked among the most necessary arts; and Agriculture is allowed to be, of all arts, the most necessary. The great object, therefore, with a humane proprietor of landed property, in erecting labourers' cottages, (the smallest buildings required for the dwellings of men,) is to make the cottagers more comfortable, and by that means render them healthy, stout, and active, and capable of that hard and continued labour which their pursuits require. If we effect these, we gain an advantage in the produce of their labour, much beyond any rent that the most penurious can wish to exact from them.

With respect to the farm-houses and out-offices, the proprietor will not duly consider his own interest, or that of his descendants, if he neglects to erect a sufficient number of substantial, suitable, and well-arranged buildings. Without these, there will be both inconvenience and loss to the farmers, and of course the utmost rent and profits cannot be obtained; and descendants will regret,—indeed, where is the landlord who inherits a large estate, and has not occasion to lament,—that his ancestors did not build more conveniently and substantially? With the requisite conveniences, judiciously situated, and

well-built and arranged, even a moderate farm will not only be enhanced in value, but will also always command a choice of desirable tenants.

Farm-buildings being intended solely for the purpose of utility, should be simple in their forms, and perfectly plain. Regularity and neatness, although not essential, may generally be made to consist with economy and convenience and in that case regularity ought certainly to be preferred to irregularity, and neatness to clumsiness and deformity. Besides, I think that neatness in his buildings will generally be found to have some influence upon the farmer, inciting him to a correspondent neatness and accuracy in the cultivation of his fields, and thus be productive of utility. The effect of orderly distribution and regular arrangement, is sometimes a modest neatness bordering on simple elegance; these are desirable accompaniments to utility, but ought never to be allowed to rival it: to utility alone, every thing else in agriculture must be subordinate. In the works of the great Architect of the Universe, however, we see beauty and utility united.

When I was first engaged in erecting agricultural buildings, I frequently found it necessary to proceed, even when I could not obtain, from books or otherwise, satisfactory information for arranging and executing such as were required. Doubtless, many architects have had a sufficient knowledge of agriculture to have qualified them for furnishing the cultivators of the earth with plans for economical and convenient buildings, had they not wanted either leisure or inclination to give this homely business a sufficient degree of attention; and yet it is the observation of an architect and agriculturist*, that "notwithstanding the infinite number of books of architecture, I do not," says he, "know of any one who has treated this subject with any degree of ability." And Arthur Young, Esq. in his Annals, vol. xxxiii. remarks, that "in farm buildings of former times, we cannot look for regularity of plan, but in modern

* See vol. ii. of "Practical Essays on Agriculture," by James Adam, Esq.

ones, I never see but with regret, here a granary and there a chaff-house, a threshing mill, scattered stalls, stables, cow-houses, and I know not what, with or without huge barns; and if you ask why any one of them is placed precisely where you find it, no reason can be given for three-fourths of the arrangement; for every building might just as well be in some other position as that in which it is found. This is inexcusable, and much more so are the modern propositions and plans of improvement, for the disposition of which no better motives are to be assigned. On the contrary, there ought not to be the smallest convenience built on a farm, down to a pigsty, that is not so precisely in the right spot, that to move it any where else would be a loss of labour or manure."

It is evident from these great authorities, as well as in consideration of the immense annual expenditure in the agricultural buildings of this country, that this matter is deserving of more attention than has been given to it, and that a work pointing out what circumstances ought to be considered, what conveniences are requisite, various reasons for particular arrangement, and a series of practical examples with a view to economy and improvement, may be acceptable to the agricultural societies, as well as to individual landlords, stewards, and intelligent farmers, who may either want useful plans, or have occasion to superintend the erection of farm-buildings.

In the following pages, my aim has been to compress such useful matter into a narrow compass as is calculated to be serviceable in the designing and constructing of agricultural buildings, and I have selected a gradation of plans for labourers' cottages, and also for farm-houses and out-buildings, suited to both arable and grazing farms of different magnitudes; and the buildings are generally so arranged, that with the explanation accompanying each design, the plans may very easily be either contracted or enlarged in any of their parts, by persons moderately skilled in drawings of this nature, so as to accommodate them to different families, or to farms of different sizes, qualities, districts, and climates.

CHAPTER I.

ON THE IMPROVEMENT OF THE CONDITION OF COTTAGERS.

ONE acre of ground was sufficient to maintain an ancient Roman and his family, and it would be sufficient for the moderns could they be content to live as frugally as the ancients. This may not be easily effected, yet surely the legislature might contrive means greatly to increase the produce of this island, by facilitating the enclosure of some millions of acres of ground in this kingdom that are capable of cultivation*: indeed, there is hardly any ground that is not; for some of the worst ground† in the kingdom, and in the bleakest situations, is built on and improved by labourers, knowing they hold it under a generous family, who never make them pay more than a mere acknowledgment. If the industrious poor man can effect so much with the worst ground, in the worst situation, what would he not effect with better soil in a genial climate? Every inch would be cultivated, and the present wide and barren wastes made to produce plentiful crops and maintain multitudes of inhabitants, and, as long as cultivated, ever must maintain them. Not so manufacturers, who are frequently removed from one country to another, accordingly as they are oppressed in the one, or solicited by superior advantages in the other.

Sedentary manufacturers would, however, derive not only pleasure but health, from employing some of their time daily in the open air. Collecting manure in their hours of relaxation, would diversify their employment, and be pursued with eagerness proportioned to the advantages they derived from it.

* This, no doubt, was written before the late extensive enclosures were made.

† The ground alluded to is supposed to be in the north.

I know it is said that manufacturers make bad farmers: admitting that the management of some of them may be defective, they are even then able to pay a greater rent in proportion for a little ground, than a farmer can for a large farm. Sedentary employment, and indeed all businesses that are not carried on in the open air, operate powerfully in diminishing the health, growth, and strength of those who are wholly occupied in them: this is very observable in Sheffield, and in other towns, where manufactories have been long established. To deprive manufacturers of the many benefits derivable from occupying a few acres of land, because it is possible they may not manage it in the most proper manner, is certainly cruel, and it will eventually prove as injudicious as it is cruel. What is it but preferring the improvement of our acres, to the improvement of the health, strength, and usefulness of our population—of those who are to protect those acres! As working manufacturers can afford to pay more rent for ground than a man who is wholly supported by farming, so I am persuaded that manufacturers may, with a little instruction, be enabled to improve the little grass ground they occupy (for it ought to be chiefly in grass), and to keep it in a higher degree of fertility and productiveness than it would ever be kept by a mere farmer.

The wonderful extension of our manufactory of cotton rarely occurs to my mind without being accompanied by the painful reflection, that much of the riches we thereby acquire is obtained at the expence of the morals, the health, and the lives of the poor people employed therein, especially of those employed in the spinning mills. As those mills not only spin cotton in a much superior manner to what it can be done by hand, but also much cheaper, it would, I conceive, be highly worthy of the attention of the legislature to limit the time for labour, so that no workman may be employed more hours daily than is found to be generally consistent with health *. This observation might be

* This, no doubt, was written prior to what has been done for their regulation.

extended to many other manufactories besides that of spinning cotton. If, however, we continue increasing our riches by the destruction of the health, strength, and vigour of our people, what are we doing but increasing the temptation to foreigners to invade us, and, at the same time, diminishing our ability to resist the plunderers *? Much may be said on this subject, and I hope some able pen will undertake the important task.

It is much to be wished that every industrious cottager, miner, working manufacturer, or tradesman, in the country, were accommodated with land sufficient for a garden, and to keep one or two cows, in order that he might have plenty of milk, roots, pulse, and herbs for his family. There is no kind of food which will supply the place of milk, and be found equally useful in rearing children. Their future health, strength, and usefulness, depend upon their having, at all times during their growth, proper food in sufficient quantities. For those who are engaged in sedentary employments tea may be proper, as it is easy of digestion, and elevates the spirits; but it is by no means calculated to invigorate the arm of the reaper, the mower, or the coal-heaver. Self-interest alone should be a sufficient stimulus, to say nothing of moral consideration, to those who employ these living engines to increase their powers to the utmost. Let any one who is obliged to employ weak men, to do work that requires the muscular exertion of powerful able-bodied men, sit down and calculate *his* annual loss, and I am persuaded he will find it amount to much more than he could have supposed.

Milk forms the principal part of the diet of both the young and the old of the Irish peasantry, who are remarkably stout and athletic. The diet of the lower classes of people in Cheshire is much the same as in Ireland, and the men of that county are, perhaps, the largest and stoutest in England. Great bodily strength is required in agriculture, and in many trades; and the success of our

* This was probably written when Buonaparte threatened to invade us.

fleets and armies depend very much on the strength and vigour of our men. In none of these employments, however, is their strength so useful to themselves as to those by whom they are engaged.

But if we wish to render their bodily powers of the greatest possible benefit, both to themselves and others, great care should be taken in educating the infant poor in virtue and piety. Devoid of these qualities, "every man's hand will be against every man," and then great bodily powers will only enable them to be more injurious to their fellow creatures.

Comfortable habitations, nutricious food, and moral instruction, will save this interesting class of the community from numberless bodily and mental evils, and greatly augment their ability to provide for themselves, and profit their country.

In the Reports of the Society for Bettering the Condition of the Poor, it is stated how very trivial the poor rates were, in the dearest times, on some of Lord Winchelsea's estates, where the cottagers were possessed of cows; and it is well known that the children of cottagers, who have some property of their own to manage and take charge of, make by far the most industrious, careful, and intelligent servants.

The daughters of labourers who keep cows, acquire in their little dairies such a degree of skill, as to render them vastly better qualified for the business of the farmer's dairy, than the daughters of the lowest rank of cottagers. Those servants are generally found most wasteful, who are brought up at home in the greatest want. Another very material consideration is, that men possessing some degree of property, are generally much better members of society, than those who live "from hand to mouth:" these last being without hope of bettering their condition, are apt to become careless of the future, and to surrender themselves up to present enjoyments to the utmost extent of their incomes, looking to their parish to support them and their families, when, by sickness or otherwise, they are disqualified from following their employments

even only for a few days. It may suffice to have touched thus slightly a subject incidentally connected with this work, but which is of itself worthy of a volume.

Although an advocate for raising the mere cottager to the possession of a cow or two, I am not convinced the comforts of society would be increased, by greatly increasing the number of small farmers. If, in some places, there be really too few, I know that in others there are too many. When I see men too contracted in skill to manage their little farms to advantage, having their bodies exhausted by labour, and their minds depressed with anxious care and solicitude least some misfortune should befal their stock or crop, and disqualify them for meeting their landlord on the rent-day, I consider their case as deplorable in comparison with men who possess a cow, and labour for others. If the chief dependance of small farmers be on some other business, their farms are almost sure to be neglected, and unproductive of the great articles of human food: the dearness of these cannot be compensated by the cheapness of eggs and poultry. The chief use of small farms is, I conceive, as steps whereby servants and labourers possessed of industry and skill, as well as a little property, may ascend to the possession of large farms, where their abilities can have full scope for exertion. Some of my relations have cottages near the extremities of their farms, in which they place better kind of labourers called hinds, who are allowed the keep of a cow in part of their wages.

It is praiseworthy to provide rich pasture and warm comfortable lodgings for our cattle with a view to improve them, and thereby to render them more useful to us; surely it must be much more praiseworthy to be active and liberal in promoting the health, comfort, and improvement of the poor; and not only praiseworthy, but evidently our interest and duty, from every consideration whether of policy or humanity. Our divine Master strictly enjoins the love of our brethren; but how can the building of palaces for horses and dogs, and leaving our flesh and blood to lodge in miserable hovels, be reconciled with this

command? Our forefathers were laudably beneficent in endowing seminaries of learning for the higher classes in society, from whence have sprung many shining characters in all the higher pursuits of life; and this country is singularly provident for the unfortunate, and for those who are old and past labour, but there is evidently, in the present state of society, too little care taken of the lower orders previously to infirmity and old age.

It has been fashionable with gentlemen to erect buildings in their grounds often merely as objects to look at; it would be happy for themselves, as well as for their poor half-starved labourers, if, in ornamenting their grounds, gentlemen were to direct their attention to the promoting of the health and comfort of those by whom they are benefitted, and by whose labour and industry they enjoy all the necessaries and all the superfluities of life; and I should hope that, in this age and nation, marked as they are by a spirit of humanity, it will be no difficult task to prevail with gentlemen to ornament their domains in a rational way, with labourers' cottages, instead of useless buildings: it is not difficult to give to cottages almost any kind of form that may be thought most pleasing. In the plans that have been selected for this work, economy more than elegance has been considered; but even such plain buildings as these, forming comfortable lodgings to honest industrious families, must give more true pleasure to the humane heart of the builder or beholder, in contemplating them, than can be given by the most magnificent structure devoid of use, whether obelisk, pagoda, or other heathen temple. Could the rich but "consider themselves interested in the appearance of their tenants and labourers, and hold the improvement of the cottage, and cottage garden, and its inhabitants, as an essential part of the improvement of their grounds," they would thus make "their seats appear the growth of plenty diffused, and not the solitary instance of wealth in the midst of wretchedness, at once its neighbour and its reproach."

The benevolent Mr. Howard told me, that he made it a rule to build a

cottage every year near his country seat, on a roomy and convenient plan. When his friends visited him, he always took them round to view these erections dedicated to humanity, and to see what care he took to promote the health, the comfort, and the morals of his cottagers. His friends could not have gratified him more than by following his example, and enjoying with him the happiness of being useful.

CHAPTER II.

ON AGRICULTURAL BUILDINGS GENERALLY.

[Under this general head, cottages, of course, are included; but this and the following chapters are intended to apply principally to the farm-houses and out-offices. Some of the observations are, however, also applicable to labourers' dwellings; and although such as are so, are not always directly pointed out, they will be readily perceived.]

SECTION I.

ON THE SITUATION OF AGRICULTURAL BUILDINGS, AND ON WATER.

"*He who builds a fair house upon an ill seat committeth himself to prison.*"—LORD BACON.

ON the situation for labourers' cottages nothing more need be said, than that they should be on dry ground, a little elevated, so that there may be no expence of drains, and that the walls and floors may be kept free from damp.

Hilly grounds, that are steep and abrupt, are not the most desirable for a farm, neither is ground that lies upon a dead flat. When a choice can be made, the preference should be given to gently waving grounds, upon a southern declivity. The summit of a gently waving hill, near the middle of such a farm, is the spot to be chosen for the homestead. It is desirable to have hills a little higher than this at a small distance, east and west, and still higher towards the north. But the situation of the farm cannot always be chosen. The buildings, however, should be erected on a dry spot, which is easy of access. A dry situation being easily kept clean, is highly favourable to the health and comfort of both men and cattle, and for dispatching the business carried on at home. A central situation, easy of access, is most eligible for dispatch in conveying home the crops, and carrying

out the manure. It is desirable the situation should be near a public road, if possible, but so far removed from it and from footpaths and thoroughfares, as not to allow improper persons any excuse for trespassing; it should also have so much elevation as to command a view of the greatest part of the farm, that, in the event of any cattle getting wrong, when great injury to themselves or growing crops might be the consequence, or other neglect occurring, they might be observed, and put right as early as possible. If the house be far from the highway, there will be much private road to make and keep in repair, also much additional fencing if the road be enclosed; and if the road be not enclosed, much damage may often be done to the crops by both cattle and people getting out of the road. It is important that the ground to be built upon be nearly level, and if not so, before the plans are made the levels ought to be taken; the removal of earth, to make the level, being much more expensive than is generally imagined. If the ground decline a little towards the south, it will, in some respects, be better than a perfect level, as the buildings on the south side of the yard, should any be required there, in that case will shade it less; and if cattle sheds are on the north side, by being more elevated, they will be drier and more comfortable for the cattle to lie down in, and the draining will be more easily effected. If cellaring be required, it is an important circumstance, as regards the expense, in selecting the situation, to have the deep drains as short as possible. In some grounds, however, to avoid making a long deep drain, a large cesspool may be made, and occasionally the water either pumped or drawn out, should the ground not be of the nature to absorb it. Before the site is fixed upon, the quality of the ground, for a foundation, ought to be ascertained: a vast difference in the expence may be occasioned, if, from the nature of the ground, it be necessary to make the foundations deep.

Previously to adding any new buildings to an old homestead, its situation should be duly considered; if the situation be bad, every pound expended in additions is diminished in value; if the situation be desirable, then a correct plan

should be made of the old buildings, to which should be added a design for completing the whole with such buildings as may be most convenient and suitable for the farm; and as often as any additions are made, they should be erected in such situations as to constitute part of the said design. By following this method, essential improvements have been accomplished, and were it followed invariably, we should, in process of time, be in possession of farm-yards that would be convenient at least, save much expence, and perhaps obtain, in some degree, uniformity and regularity in the buildings.

For the sake of neatness as well as convenience, it is desirable to have the meadows and cow pastures surrounding the house; next beyond these may be the arable grounds; and the fields at the extremities of the farm, will be most conveniently occupied as pastures for horses, sheep, and young cattle, provided the nature of the ground will admit of this distribution.

Physicians, ancient and modern, who have attended to the effect of situation upon the health of mankind, observe, that a gravelly soil upon the banks of a quick running stream is in general a healthy situation, while a rich and marshy soil on the side of a slow running water is the reverse, and that stagnant waters render a situation peculiarly unwholesome.

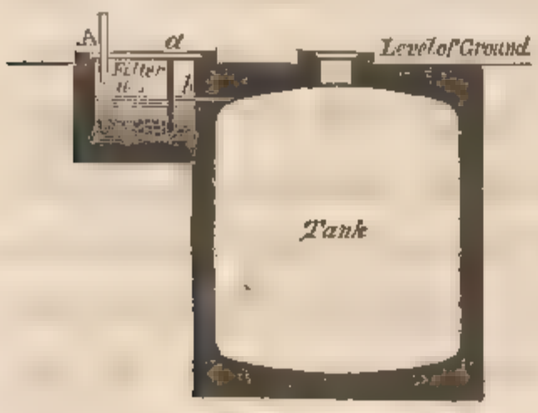
Many of the foregoing circumstances and conveniences are obviously of importance to be attended to in selecting the situation for the homestead, and yet some that are desirable are frequently wanting where they might have been had, while others which are injurious, or inconvenient, might have been avoided.

To have a command, without expence, of plenty of good water, is most desirable; but the extremities of farms should not always be preferred on this account, and low, damp, and dirty situations, although with this convenience, should be avoided. If the most desirable spot in other respects be destitute of water, a supply may more frequently be obtained than is generally imagined on high grounds, by diverting the course of a rivulet, by artificial springs, by sinking a well, by forming a pond, or which perhaps is the most important of all, as it

never fails, by putting spouts round all the buildings to collect the rain water which falls upon them, into one, two, or more tanks: by this last means, a sufficient supply of water has been collected from the roof of a cottage to answer every purpose of the family during the driest season, while other cottagers in the neighbourhood having only ponds, had to travel miles for water. Ponds having a large surface exposed to the sun and air, soon lose a great proportion of water by evaporation; the water in a covered tank is not liable to this loss, and will keep quite clean, and if properly ventilated, will always be sweet. The quantity of water that falls annually upon every hundred superficial feet or square of building, is about 1,400 imperial gallons. Besides the water collected from the buildings being useful, the buildings themselves will be benefitted by the spouts, as the walls and their foundations will be kept much drier, and will last longer than they would do if all the water from the roofs was suffered to fall upon them.

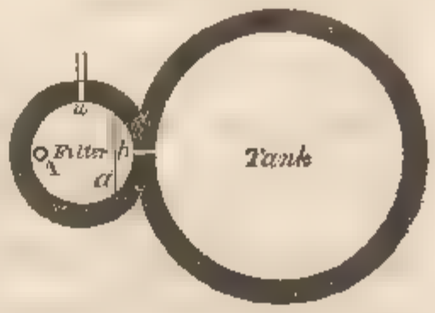
A circular plan is the best form for a tank; the bottom should be in the form of a flat dome reversed, and the top also domical, with an opening left in the centre of sufficient size to admit a man to clean it out occasionally; the top of this opening should be a little above the surface of the ground, and should be covered with an oak flap, with several holes bored in it for ventilation, or the cover may be an iron grating, horizontal, and a little elevated, or conical. These tanks may be constructed of various dimensions, the depth and width should be nearly equal; a hole should also be left for the service pipe, or that which conveys the water into the tank, and also for the pipe for the pump, if the water be drawn out by that means. The water may be filtered previously to its entering the tank, the hole for the service pipe ought therefore to be near the top, and on that side most convenient for the filtering chamber; this may be about four feet diameter, and three feet deep: across this, about twelve inches from the

SECTION.



side next the tank, as at *a* in the annexed figures, a slate partition from the top to within about six inches from the bottom, should be fixed; at the bottom of the box should be put clean coarse sand or pounded charcoal, about a foot in thickness. The pipe or opening from the filter to the reservoir, should be of ample dimensions, and be made at about eighteen or twenty inches from the bottom, in the small division or space behind the slate, as at *b*. Above this opening, and in any part most convenient, as at *w* in the large division of the filter, should be an opening or drain to carry off the water when the tank is full. This filter should also have a cover, that it may be cleaned out, and fresh sand, or other purifier, put in as often as may be found requisite. Of course the water, as it comes from the roof, is to be first conveyed into the large division of the filtering chamber, on the opposite side to the slate partition as at A, and passing through the sand it rises in the small division purified, when it is fit to pass into the tank. If there are two or more of these filtering chambers, or if they are of greater depth, the water may be passed through the greater quantity of sand, &c. in them, and be still more purified. Both the tanks and the filters should be water tight; if constructed of brick, the inner course may be built with Roman cement, and afterwards the whole of the inside covered with a coat of about three quarters of an inch thick. Water, from drains formed in the ground for the purpose of collecting it for domestic purposes, may be purified, by passing it through a sand filter previously to its entering the tank or reservoir. Sponge and flannel may also be used as filters.

PLAN.



In constructing tanks of the above description, care must be taken to have the earth closely filled around the brick-work, and to allow sufficient time for the work to get properly settled, previously to admitting any great weight of water.

Cisterns for water formed of blue state, or Yorkshire paving stones, are much better than those made of wood, and lined with lead.

SECTION II.

ON THE ASPECT AND SHELTER OF FARM-BUILDINGS.

THE principal front of the house, and that side of the farm-yard which is least sheltered by buildings, should generally face the south; but whether exactly or not will depend, in some measure, on the shelter afforded by adjacent grounds or woods. If there be no shelter from woods, in the most desirable situation, this may often be obtained by judicious planting. As the wind rarely blows from the south-east, and as our most constant and most violent winds are from the south-west, it would seem that one point to the east of south will generally be the best aspect. The north-east corner of the house being least affected by the heat of the sun, and consequently the coldest, should, therefore, be chosen for the dairy: as to the other rooms, their aspect is not very material. Farm-yards should be well sheltered on the east, west, and north, by connected buildings; but enclosed on the south by a fence wall only, or such low buildings as will not exclude the rays of the sun from any considerable part of the fold-yards. In the mountainous parts of England, where the climate is too cold and too wet for the profitable production of corn, the farmers very prudently house all their cattle in winter; in that case the aspect of farm-buildings is of less importance; but on arable farms, fold-yards screened from cold winds, and open to the sun, as above-mentioned, are preferable to cow-houses for young cattle, and, indeed, for cattle that are fattening, provided there be sheds for them to retire under in wet and cold weather.

It is well known that in rainy weather, even in summer, cattle of all kinds are chilled and injured by wet, which retards the growth of the young, the fattening of the aged, and diminishes the milk of cows. In cold, rainy, or snowy weather, in winter, the effects of want of shelter are doubly injurious in all these respects.

SECTION III.

ON THE GENERAL ARRANGEMENT OF FARM-BUILDINGS.

IT is desirable that the farm-house should be placed either at the south-west or south-east corner of the farm-yard, or at a little distance southward from the middle of it, with one of its fronts towards the yard: there should be, at least, one window of a room on the ground-floor, that is constantly occupied, and also a window of the farmer's bed-room that should face the yard, that not only every thing therein may be seen from within the house, but also, in some degree, even the interior of some of the out-houses, at such times as their doors are open. It is also desirable that some of the windows command a view of the farm, and also of the approach to the house. Servants and stock cannot be too much under the eye of their master. When a dwelling-house is to be placed southward of a farm-yard, it ought to be at such a distance from the yard that its shadow at noon may not reach across it. In the latitude of London, the length of shadows on an horizontal plane when the sun is in the meridian, on the shortest day, is about equal to $3\frac{2}{3}$ times the height of objects. On the 23d November and 19th January, they are equal to three times the height. The back of a farm-house in front of the yard ought not, therefore, to be placed much nearer to the north side of the farm-yard, than four times the height of the house.

That cattle and hogs may be kept at a proper distance from the house, it will be advisable that a small court intervene between it and the yard. It is certainly highly conducive to the health of the inhabitants, to have the house so far from the steam and effluvia arising from the dung, and other putrifying substances, in the farm-yard, that the smell of them may not be perceptible within the house; besides, bad smells greatly lessen the products of butter dairies, by preventing a complete separation of the cream from the milk. On arable farms,

the hog-sties, with hen-roosts over them, will be conveniently placed on the south side of the farm-yard: in that situation they will be near the house and brew-house, from whence much of the food for hogs and poultry will come, and being low buildings, the sunshine will not be excluded by them from the cattle in the yard: the stable should be so near to the house, that when any thing is violently wrong among the horses, it may be heard into the house.

On a large farm, the barn with a thrashing machine and straw-room, should be placed on the north side of the yard, and the cattle-sheds should extend eastward and westward from the straw-room, for the purpose of readily foddering the cattle. Over the straw-room may be a granary, into which the grain may be lifted by machinery, worked by the thrashing machine. On the east and west sides of the yard, the stables, cow-houses, and cart-sheds should be placed. The entrance into the yard should always be on or near the south side; sometimes the arrangement may require variation from local circumstances, as the approach, inclination of the ground, natural shelter, and from buildings already erected.

SECTION IV.

ON THE FORM AND PROPORTION OF BUILDINGS.

A SQUARE building requires less wall to enclose it than any parallelogram of equal area, and the more a building deviates from the square, the more wall it will require to enclose a given area. The area of a building twenty feet square, is four times as large as a room ten feet square, but it requires only twice the length of wall to surround it. Hence houses which consist of large rooms are erected at less proportional expence than those which consist of small rooms;

if, however, the walls were made proportionally thick and high, there would be no difference in that respect; but the smaller buildings have their walls generally proportionally thicker and higher. A room in a farm-house, for example, ten feet square, would not be considered too lofty if only eight feet high; but a room, although twenty feet square, need not be sixteen feet high. The plastering of the walls, &c., and boarding of the floors, require to be as thick for a small room as a large one, and perhaps as many doors to the one as to the other may be requisite. The expence of joists and rafters is in favour of small rooms, as in these the timbers may be of less scantling, and will require less proportional labour and skill in the execution, than when the buildings are wide, and the timbers require framing and trussing.

I may just repeat here, that a square contains more area than any other parallelogram of the same circumference, and that a small area requires more circumference in proportion than a large one, as these facts are particularly applicable to the enclosing of ground. A fence to a small field is required to be as high and as strong as for a large field; if, therefore, we make the fields of smaller size, or more oblong than is necessary to cultivate them to the best advantage, we unnecessarily increase the length, and thereby the expence, of the fences, and also diminish the quantity of culturable soil. These evils, if they once take place, are likely to continue, for it is rarely that the remedy can be prudently attempted.

A double house, consisting of four rooms on a floor, will require a less quantity of wall than if the same proportioned rooms were arranged as a single house in a straight line, or in the shape of either of the roman letters L or T; besides, in single houses, much room is lost and expence incurred, in long passages, and much time must be lost in passing along them. In a small single house, or a double house covered at two spans, the space within the roof is trivial, and too low to be occupied with convenience; but within the roof of a double house, covered at one span, there is twice as much space, but no more

roofing, and that space may generally be made sufficiently lofty for various useful purposes.

Utility, durability, and economy, are best obtained by adhering strictly to simplicity of form, and building with good materials. Let the buildings be quadrangular, as nearly square as other circumstances will allow, and roofed at one span. Avoid lead gutters, and such projections as bow windows, dormer windows, &c. These are not only expensive to construct, and keep in repair, but are often the cause of much damage to other parts by the overflowing of water, particularly after snow.

The increase of the sizes of farm-houses is not required to be in the same ratio as the extent of the farms; that is, the dwelling-house for a small farm must be proportionably larger, and consequently will cost more, in proportion, than one for a large farm. The cost of cattle-sheds, cow-houses, and stables, will be nearly in the same ratio as the sizes of the farms, provided the lands be of the same quality, and in like situations.

SECTION V.

ON LIGHT, VENTILATION, AND RENDERING HOUSES HEALTHFUL.

THE rooms in farm-houses are seldom so large as to require more than one window to light one room; but for the purpose of having a more extended view of the farm, or for overlooking the farm-buildings, two windows in a room, in some cases, become necessary: of whatever size a window may be, the nearer its top approaches to the ceiling, the more light will be admitted; the lower half of a window will be found to admit much less light than the upper half; the comparison may be easily made by darkening either half alternately. For the purpose of ventilation, the upper part of every window ought to be made to

open, and, on this account, it is also advantageous to have the top of the window as near the ceiling as possible.

Closets and concealed beds are very improper places to sleep in, especially for young people and invalids. No bed-room ought to be without a window, for by means of the window and door, it may be speedily and perfectly ventilated: the window and door being thrown open, causes a sudden draft, which soon sweeps out the bad air accumulated during the night. The window should be thrown open a short time during day-light every day, except when constant rain, or thick fogs, have rendered the external air more unwholesome than the air in the room; and then it may be prudent to ventilate it by means of the door and chimney, moving the door backwards and forwards for a few minutes. The windows of bed-rooms ought always to be shut before the sun has set, for then the dew begins to fall. Lofty rooms, in dwelling-houses, are much more healthful than low ones, and when disorders occur in such rooms, they are less infectious: this important improvement in rooms is obtained by only a little additional expence of walling. The floors and roofs, which are the most expensive parts of farm-houses, cost exactly the same whether the rooms be lofty or low. All bed-chambers ought to have chimnies, if it were only for the purpose of ventilating them, and keeping up a circulation of air during the night; to the sick, and such as are of weakly constitutions, this is of more importance than is commonly imagined by those who have not, in a state of sickness, experienced the want of fresh air. Bed-rooms, which have been built without chimnies, ought to have small ventilators through the walls near the ceilings, or in the top of the window-frames, so constructed that the corrupted air may escape out of the house, and that rain and snow may not enter. Bed-rooms in new buildings, in addition to the chimney for the fire, may be also ventilated by carrying up a small flue (about six inches square will be sufficient) from the top of the room, either adjoining those from the fire, or in any other convenient situation. As this is done without expence in new

buildings, cellars, and even stables, may also be ventilated in the same way: for stables, larger flues would be requisite.

The late benevolent Mr. Howard, in his State of the Prisons, page 215, says, "In my various journeys through England and Wales, I have seen many houses deformed on account of the odious tax on windows; and I cannot help repeating my concern for its pernicious effects. I am persuaded it has a very bad effect on the health of the lower classes of people; and this may be one reason of their not having now such healthy and ruddy complexions as they had formerly." No doubt Mr. Howard's opinion is correct, and as garrets in farm-houses are frequently occupied as servants' bed-rooms, it would, in my opinion, be highly prudent in the Legislature, to exempt the windows of garrets so occupied from the duty. This certainly is of as much importance as exempting the windows in dairies and cheese-rooms.

I am sorry here to remark, that the health of servants is often less attended to than the health of cattle, which is highly impolitic in many points of view, to say nothing of its inhumanity.

Too often there is neither chimney nor window by which to ventilate servants' bed-rooms, and when there is no window, they are not likely to be properly cleaned. What renders them still worse is, their being partly occupied as store-rooms for green-fruit and bacon, and for drying new made cheese; the effluvia from all these articles contaminates the air, and renders it greatly injurious to the health of those who breathe it; indeed, all strong-scented bodies, placed in bed-rooms, are more or less pernicious. I shall, therefore, enumerate a few more of those things from which farmers and their families not unfrequently suffer in their health, without being, perhaps, at all aware of their pernicious effects. The air of rooms is rendered unwholesome by keeping in them oil, oil colours, impure wool, sweaty saddles, soap, tallow, fat, fresh meat, whether raw or dressed, wet clothes, and other wet articles; by foul linen, washing, drying and ironing; by the fumes from charcoal fires, which are

extremely pernicious, and frequently fatal; by green plants and flowers, however fragrant; and by saffron and hops, which last articles, Dr. Willick says, have also sometimes proved fatal.

Besides freeing dwelling-houses from these, and all other strong-scented articles, they ought to be kept perfectly clean, and occasionally white-washed. Mr. Howard, from whom I have already quoted, observes, "that lime-whiting is attended with very little expence, is exceedingly salutary, and tends to inspire young persons in particular with a love of cleanliness." Of this last circumstance "I am," says he, "convinced from experience, as I have repeatedly observed, that when I have pulled down an old cottage that had clay floors, and no pantry, no pump, no out-house for fuel, nor any vault, and have built new ones with these conveniences, which have also been white-washed both within and without, the very same families that were before slovenly and dirty, have, upon this change, become clean and neat in their persons, in their houses, and gardens."

Damp houses are, to those who inhabit them, a certain source of numerous diseases; more particularly rheumatic affections, and these often to an excruciating degree. This miserable complaint frequently reduces mankind to premature decrepitude, and always renders them infirm in some degree, and consequently so much less able to undergo the labours to which otherwise they would cheerfully submit. Policy, therefore, as well as humanity, strongly impels us to obviate, as much as possible, this premature infirmity, decrepitude, and misery.

If, through unavoidable necessity, a dwelling-house must be built upon damp ground, the ground-floor should be raised eighteen inches at least above the surface, and upon the driest ground it ought to be raised not less than nine inches. To prevent the damp rising up the walls, a few courses may be built with Roman cement, and the last course thus built, which should be below the floor, ought to have a coat of about three-quarters or an inch thick

all over it. In houses that have cellars, the additional expence of raising the ground-floors eighteen inches will be trivial. The floors of all out-buildings should be laid at least six inches above the surface. No part of external walls to dwelling-houses, in exposed situations, should be less than a brick and a half in thickness, unless cemented on the outside to keep out the rain. The inside of the walls should never be built with flints, nor any other stones that contract dampness. Bricks are the best for this purpose.

CHAPTER III.

ON THE SEVERAL CONVENIENCES IN FARM HOUSES AND ATTACHED OFFICES.

EVERY farmer may not require distinct rooms for each of the following purposes, yet such an alphabetical list, it is thought, will be serviceable, as most farmers require the greatest proportion, although sometimes one room may be used for various purposes. Without such a list some conveniences may be omitted, when a design is made, that may be difficult to arrange satisfactorily afterwards. The figures following the names of the several conveniences, refer to the articles where observations are made upon them.

Ash-pit or dust-house 6	Chaise-house 6	Dairy (milk room) 4	Privy 6
Back or common kitchen 1	Chambers..... 3	Dairy-scullery..... 4	Shed,..... 4
Bacon-room 1	Cheese-press-house 4	Fuel-house 7	Store-room 5
Bake-house..... 1	Cheese-room 4	Kitchen 1	Tool-house 6
Brew-house..... 1	Cider-house 1	Pantry 5	Wash-house..... 1
Cellar 2	Coal-house 7	Parlour 5	Wood-house..... 7
	Counting-house ... 5	Porch 1	Wood-yard..... 7
	Court-yard 6	Potatoe-place..... 2	

Art. 1. *Back Kitchen, Bacon-room, Bake-house, Brew-house, Cider-house, Kitchen, and Wash-house.*—In the smallest farm houses, two rooms serve for all these purposes. It is desirable, however, that the bake-house and

brew-house should not be within the dwelling-house, but in a low building attached, as the vapour arising from both baking and brewing are injurious to health, as has been stated in the last Section. A room sixteen feet wide may be fitted up to be very convenient for these purposes, and for washing. In the middle of one end of it should be a fire-place, wide enough within the jambs to contain a grate or range, with a small boiler on one side of it, and an iron oven on the other. Without the jambs on the one side, the large boiler or copper should be fixed; and on the other side, should be the mouth of the brick oven, and a few inches before it, an opening about two inches wide, and in length equal to the width of the mouth of the oven, through which opening the ashes, when drawn out of the oven, fall down into a place made below to receive them, by which means they are prevented from being blown about the room. It is desirable that the brew-house should be so placed that, by means of a short pipe or trough, the liquor may be conveyed into the cellars. Where water is obtained at a sufficient height, it may, by means of pipes, be conveyed to the boilers, &c., as well as to other buildings; or pipes may be connected with the pump for these purposes, as that expence will be trivial, but the saving of labour would be considerable. It is also desirable to have elevated cisterns to contain a supply of water for immediate use, particularly to sinks, and such other situations where small quantities of water are frequently wanted. The kitchens ought to be so placed that, at least, the windows of one of them should overlook the farm-yards. In the smallest farm-houses, the entrance door opens directly into the kitchen; in larger houses into a porch, and sometimes into a passage or hall. If the kitchen be the common sitting-room, it should, like the bar of an inn, be so placed as to command a view of the doors of all the rooms where the chief daily business is transacted. Upon racks in the kitchen is generally the place for keeping the bacon, but a separate room or closet, with a draft through it, is preferable. The height of the kitchen or ground-floor may be about nine feet.

Art. 2. *Cellar, Potatoe-place, &c.*—If the cellars are under any other rooms than the parlours, it will be necessary to arch them over; but it is less expensive to make them under the parlours, and board the parlour floors. The stairs to the cellar may descend under the other stairs. Cellars, in damp situations, ought to have double or hollow walls, or areas on the outside. Where a long and deep drain would be required if the cellar was under the parlour, it may be necessary, to avoid such great expence, to place it in some other situation, sunk perhaps only a few steps, with hollow walls to keep out the heat and cold, or a bank of earth raised against it. The cellars may be about six feet six inches high.

Art 3. *Chambers or Bed-rooms.*—The first floor and attics, or garret, are usually appropriated for this purpose. In some cases one of the parlours, if on very dry ground, or if there be a cellar under it, may be used as a bed-room for the farmer. When bed-rooms are within the roof, if only two, it will be best to light them at the gables; dormers being expensive, and often out of order. The men servants' bed-room, both for decency and convenience, ought not to be up the same stairs as the bed-rooms for the family. It may sometimes be conveniently placed over the dairy. Chambers should be at least eight feet high. Rooms in the roof should not be less than six feet three inches.

Art. 4. *Cheese-press-house, Cheese-room, Dairy, Dairy-scullery, and Shed.*—These are properly all connected with the dairy. In some cases the cheese-presses may be in the dairy-scullery, which should contain a boiler; and on small farms, where little cheese is made, the back kitchen is appropriated for both these purposes. An open shed, adjoining the back kitchen, is a great convenience for drying and airing dairy utensils, and performing many other operations, by which a small house particularly is greatly relieved. The cheese-room may also be used as a store-room.

Dairies should be kept, as nearly as possible, at the same temperature in all

seasons of the year: this is of vast importance where butter is the chief object. For this purpose various means have been devised. A milk-room, sunk three feet within the ground, and a sloping bank raised against its walls externally, to the height of three feet, with the earth dug out of it, will be found nearly as cool in summer, and warm in winter, as a cellar, but more convenient to occupy, as four or five steps to descend into it will be sufficient.

I was led to this mode of constructing half-sunk dairies, by having first constructed a cellar in a similar way. This I did in order to save the expence of making a long and deep drain or sewer, and this cellar equalled my expectation in keeping beer and other liquors in good condition. A half-sunk dairy I made many years ago answers so well, that I am told one-tenth more butter is obtained in it than was obtained in the old dairy; but, indeed, the old dairy was partly used as a pantry, which no doubt contributed to prevent the rising of the cream. In the intense frosts in the two winters of 1798 and 1799, the milk kept in this dairy never froze, and was so little affected by the cold, as to occasion no sensible diminution of cream. There can be no doubt that dairies, thus constructed, would be found equally advantageous where butter is made in summer. In this dairy its utility, in this respect, has not been attended to, the summer produce being cheese.

If the walls of a dairy be made hollow, it will be warmer in winter, and cooler in summer, than with a solid wall built of the same quantity of materials: the outside wall may be nine inches, the inside wall, brick on edge, tied to the nine-inch work by headers, at about every five courses; the cavities between the walls to be about two inches.

When circumstances will permit, it will be found an additional means of preserving the equal temperature of a dairy, if a rill of water from a neighbouring spring be conveyed through it: this must bring along with it a temperature corresponding nearly with that of the earth at the depth from which it comes, and consequently will be much warmer in winter, and cooler

in summer, than the external air. When the temperature of the air in the dairy is from fifty to fifty-five degrees, there is reason to believe that the separation of the cream from the milk goes forward with the greatest regularity. The milk from the cow ought not to be taken too warm into the dairy, as a large quantity of warm milk would alter the temperature of the room; if too warm, it may be allowed to stand to cool in the dairy-scullery, or in the open shed. The floors and benches in dairies are, in some places, laid with paving tiles: smooth free-stone flags, similar to some of the thinnest Yorkshire flat paving stones used for the foot-paths in London streets, make cheap and excellent benches and shelves for dairies; the large blue slates also, will answer well for shelves; these, as well as the floor, should be daily washed to keep them perfectly clean and sweet, and the walls and ceilings should be frequently cleaned and whitewashed. From the great quantity of water thrown on the floors of dairies to keep them clean, sweet, and of the proper temperature, it is necessary to have a drain, and this should have a trap, to prevent any smell arising from it. Nothing but milk and cream should be kept in dairies; nor any thing that has a strong scent, although it may be sweet, should ever be placed in or near the milk-room; but bad scents particularly greatly lessen the product of butter dairies, by preventing a complete separation of the cream from the milk.

A cream gage is a very useful appendage to a dairy: this is a glass tube, exactly cylindrical, of about one inch in diameter, and ten inches and a half long. On its outside is a graduated scale three inches long, and each inch is divided into ten equal parts. The scale commences at the height of exactly ten inches from the bottom of the tube; it is numbered, and counts downwards: being filled up to ten inches high with new milk, of a proper temperature, it is set by in the dairy for twelve hours, in which time the cream will all of it have risen to the top of the tube, if the cow be a proper one from which to make butter.

I have before me the result of experiments on the milk of several cows. From some of the greatest milkers, the cream was an inch and seven-tenths thick, fully equal to one-sixth part of the milk put in: this rose in twelve hours, and no more was produced by standing longer. In one example, seven-tenths of an inch of cream rose in twelve hours, and three-tenths more in the second twelve hours. In another example, no cream rose in the first twelve hours, four-tenths rose in the second twelve hours, and one-tenth more in the third twelve hours. We may easily suppose that this last cow's milk, when mixed with the milk of ten other cows, must have greatly retarded the rising of the cream in the whole of the milk, and probably much of it would not have arisen at the end of twelve hours, to the great loss of the farmer. The richness of the cream of some cows is greatly inferior to that of others, and it ought to be proved.

Where cheese is made, it is advisable to ascertain the proportion of curd produced by each cow's milk. A gallon may be put in a separate vessel, and the rennet added to it, and when coagulated, and the whey expressed from it, the curd to be weighed.

Art. 5. *Parlour, Counting-house, Pantry, and Store-room.*—The parlour not being designed for common use, ought to be placed at the front, and as much out of the way of the daily and constant business of the house as possible. A counting-house is a necessary and valuable convenience to have separate, where there are many workmen to pay, and money concerns to be transacted; it is desirable that it should command a view of the entrance to the yard, and also the approach to the house. The pantry and store-room should be conveniently near the common sitting-room; and if not within the principal part of the house, but in low attached buildings, the better, for reasons stated chap. 2, section 5.

Art. 6. *Court-yard, Chaise-house, Privy, Ash-pit, and Tool-house.*—The court-yard should extend as far as the attached offices, that cattle, pigs, &c. may be kept at a proper distance from the house. One or more tanks may be built under this yard for the hogs' wash, with oak covers, as for the water tank.

When a chaise-house is required, it may form part of the attached offices. If the privy adjoin any other building, the walls of the cesspool ought to be hollow or double, and either puddled, or lined with Roman cement, to make it water tight. When a drain is required it should have a trap; from the underside of the seat, a trunk or flue should be constructed to carry off, above the roof, any smell that may arise: if, however, the cesspool be air tight, so that no air may be admitted below the seat, which always ought to have a cover, the air would then be stagnant, and the smell not likely to ascend. The tool-house may also, in some cases, serve for the cheese-press-house, and also for dry pigs' food.

Art. 7. *Coal-house, Fuel-house, Wood-house, and Wood or Coal-yard.*—These, though differing in name, are all intended for fuel. If but one place be appropriated for this purpose, the coals and wood are put together: when much wood is used, it is desirable to have both a yard and a house for this purpose, as well as a place for coals: the yard for the wood previously to its being cut up, and the wood-house to contain a supply dry and ready for use: in some places a house for coals is not considered requisite, a yard being deemed sufficient.

CHAPTER IV.

ON THE OUT-OFFICES OF FARM BUILDINGS.

THE following is a list of conveniences, some of which are required in the out-offices on every farm. The figures following shew the articles referred to.

Barn.....	1	Feeding-house.....	4	Hogsty.	7	Slaughter-house ...	8
Boiling-house	7	Foddering-bay.....	4	Horse-track.....	1	Stable	5
Brining-room for Wheat.....	8	Fold-yard	3	Loose box	5	Stable-yard or court	5
		Forge.....10		Meal-girnal.....11		Store-house.....	4
Bull-house	4	Goose-house	7	Pigeon-house	7	Straw-room	1
Calf-house	4	Granary	2	Plough and harrow-place.....	6	Thrashing machine	1
Cart-house, lodge, or shed.....	6	Harness-room	5			Tool-house 10	
		Hay-room	4	Poultry-yard.....	7	Turkey-house.....	7
Cattle sheds.....	3	Hen-roost.....	7	Privy for the men	10	Turnip-cistern	4
——- troughs.....	3	Hog's-court.....	3	Saddle room, or closet	5	—— house.....	4
Chaff-room	5	Hog's food-house...	7			Waggon-hovel.....	6
Cottage or bothey	11	—— tank	7	Sheep-house.....	9	Wool-room	6
Cow-house	4	—— troughs.....	3	Sick-cattle.....	4	Workshop.....10	
Duck-house	7						

Art. 1. *Barn, Straw-room, and Thrashing Machine.*—Ideas of the number, size, and form of barns, in this country, vary in different latitudes. In the north, one comparatively speaking small barn, with a thrashing-machine, is considered sufficient; in the south, by some, as many barns as kinds of grain are

deemed requisite; and these must all be of large dimensions, with porches, thrashing floors, and large doors to admit loaded waggons. The objections to many and large barns, are the expence of erecting and keeping them in repair, also, that grain cannot be carried with safety so soon, when it is to be put into a barn as into a rick, and that both grain and straw are not so sweet out of the barn as out of the rick. These last observations are equally applicable to hay. Rick cloths answer most of the purposes of the Dutch barns, and some of the advantages of a barn that will admit a loaded waggon: if, however, large barns are required, it may be proper to point out some things which perhaps may be deemed improvements, at least as regards the expence. A barn with porches is the most expensive description, and such projections are aukward, particularly towards the fold-yard: that barns thus constructed are of the most expensive form, will appear by comparing the following observations and accompanying figures.

FIG. 1.

Fig. 1. Plan of a barn with porches, which covers 1,368 square feet, and its circumference (including an additional foot for each external angle of the porches) is 218 feet.

FIG. 2.

Fig. 2. Another plan of a barn, which covers 1,369 square feet, being one foot more than fig. 1, and its circumference is 148 feet, being 33 per cent. or nearly one-third less; the roof of this, as it has no vallies, although of a wider span, will not be more expensive than the other, particularly if it be supported by posts, which will serve as divisions; besides, this will hold double the quantity of grain within the roof; if it be of the same pitch, and if required to hold no more than fig. 1, it may be made of less area. A barn of the same length as fig. 1, and 22 feet 10 inches wide, will contain the same area, with more than 25 per cent. or one quarter less of circumference.

FIG. 3.

FIG. 4.

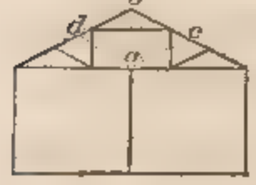


Fig. 3. Shews two barns together; two separate barns of the same size would cost much more; besides the saving of one external wall, the middle wall need not be so expensive, and two doors would serve, which, if large ones, would be a considerable saving.

Fig. 4. Shews that if fig. 3 was roofed at one span, no more roofing would be required than for the two separate barns, $d\,b$ being equal $d\,a$ and $c\,b$=$c\,a$; and in this way there would be double the space in the roof, which might be appropriated for a granary, into which the grain might be raised by machinery.

By making all the farm-buildings double, in the way pointed out for the barns, there would of course be a great saving in them, but then there would not be sufficient buildings to enclose the three sides (east, west, and north) of the farm-yard; and if the walls were made so high as to afford the same shelter as the buildings, there would be no saving: but if there are more buildings than sufficient for forming the three sides, some of them may be made double, and as the barns are higher than what is necessary for shelter, by making them double, the saving will be the greatest. When a waggon has to be loaded over night, it is advantageous to have some building under lock and key that will admit it: this may be considered an argument in favour of at least one pair of large doors to a barn.

As complete thrashing machines may now be erected at from forty to eighty guineas, some of which will thrash from fifteen to twenty-five bushels of grain in an hour, it will be found greatly preferable to most arable farmers, of above £100 per annum, to provide himself with one. These machines thrash out the grain much cleaner than is done by flails, obtaining, as it is said, one-sixteenth more grain at about half the expence of labour. These important facts will have due weight with wise landlords, and induce them to be liberal in

promoting the erection of thrashing machines upon all their arable farms of sufficient magnitude. Where there are many small farms together, one thrashing machine will serve a whole village; and the proprietors will ultimately receive the benefit of these savings. In one barn, with a thrashing machine, all the grain produced on the largest farm may be thrashed.

A barn suited for a thrashing machine may be about eighteen feet wide, fifty or sixty feet long, and twelve to fifteen feet high; the height of the winnowing room about eight feet. Such a barn is sometimes divided into three bays, one of the end bays to receive the unthrashed grain, the middle bay to contain the thrashing and winnowing machinery, and the third bay for the clean thrashed straw delivered by the rake of the thrashing machine. In some places, the unthrashed grain is taken by two, four, or more persons, in canvas hand-barrows, from the rick, up an inclined plane or gang-way, to the floor over the winnowing room, as it is required by the person who feeds the machine: in this case no separate bay is wanted for the unthrashed grain; but in either of these cases, as small doors will be sufficient, large doors to admit carts or waggons may be dispensed with. If there be a bay for unthrashed grain, it may be filled at a pitching hole at about half its height; in the other case, a door wide enough to admit the hand-barrow will be as large as is required.

The machinery is sometimes worked by water, in some places by manual labour, but more generally by horses, and may be worked by wind, or any mechanical power. If the horse-track be at the back of the barn, the form of the roof of it may be a hexagon, hipped up to a point: this form will admit the full light of day to pass through a window in the barn wall, a little above the feeding board of the thrashing machine, which ought to be well lighted, to enable the man who feeds the machine to spread the unthrashed grain evenly and not too thick, upon the feeding board, for upon these two circumstances the clean thrashing of the grain greatly depends. The horse-track should be about eight feet high to the eaves. A barn of the above description,

with a thrashing machine, will be found less expensive than one large barn with large folding doors to allow waggons to pass through, and a large barn floor formed of thick planks and sleepers.

In some hilly countries they prefer having their barns over their cow-houses. It is considered quite sufficient to have noticed this circumstance, for unless in very particular cases, it is apprehended that no satisfactory argument can be assigned for such an arrangement.

Art. 2. *Granary.*—The situation for a building for this purpose should be dry, and the building should be well ventilated, and have a good aspect, besides being placed over the barn or straw-room: the granary may be placed over any other open building, as the cart or waggon hovels, but ought by no means to be placed over close cow-houses or stables. In some situations it may be desirable to support and strengthen the floor by framing. Fig. 1, chap. v., sec. 5, has proved effectual for this purpose. These trusses may be arranged so as to form the divisions for the bins for the different kinds of grain: some persons prefer the bins detached from each other, and from the walls; this of course is more expensive, as it requires more wood, and there is also a loss of room: the walls, however, should be boarded. The head room, under the beams in granaries, should be at least six feet.

Art. 3. *Fold-yards and Cattle-sheds, &c.*—Fold-yards and cattle-sheds, where the climate is not the most severe, will be found of the greatest advantage to both the cattle and the farm. The opening or front of the sheds, should be at least seven feet high. By protecting the cattle from cold, rain, and snow, they will be kept in better condition, and by not foddering abroad, less food will be required; the ground will not be poached, the best straw will be eaten, the litter and dung the cattle will tread together, and a great quantity of valuable manure will be obtained for the farm. The fold-yards and cattle-sheds ought to be of ample dimensions; the first to receive all the litter, &c. convertible into manure, with sufficient room for preparing and turning it,

otherwise double cartage will be requisite, and the latter to afford sufficient shelter for all the cattle. On every considerable farm, where cattle are bred and reared, the farm-yard ought to be divided into at least three fold-yards, in order to keep apart horses and cows, and the different kinds, strengths, and ages of the latter. By lengthening the cattle-sheds, which are the least expensive erections calculated to afford shelter, the farm-yards may be enlarged to any extent; if the sheds are long, they ought to be divided by walls or close boarded partitions, by which means they will be rendered warmer. All projections within the fold-yards ought to be avoided, as the cattle may be endangered thereby, and a view of some part, or building, prevented. For the store pigs in the fold-yards, a small space or court next one of the walls or angles should be railed off, where the troughs for their food may be placed, that they may eat undisturbed, or retire to when pursued by the cattle; and openings should be left in the walls to allow them the range of the whole. When, from necessity, the entrance into the fold-yards must be made on any other side than the south, it ought to have close boarded gates, or trees planted at a proper distance, to break the wind. In many situations, a plantation judiciously made would be of great service, both in protecting the buildings from high winds, and in making the yards more comfortable for the cattle in severe cold weather. It is very desirable to have the fold-yard walls sufficiently high to prevent the cattle pressing against the tops of them; on this account they ought not to be lower than five feet, or five feet six inches. The fold-yards should be paved for a convenient breadth, gently sloping in front of all the buildings. The middle of the yards should be hollowed something like the form of a dripping pan, to drain the moisture from the buildings and sheds, to keep the cattle dry and comfortable; the bottom and sides of this receptacle for the dung and urine, if not naturally water-tight, should be made so, that the drainings may not soak away into the ground; the drainings and overflowings should then be conveyed, by a covered drain, to the

outside of the yard, and there filtered through a sufficient quantity of peat or other earth to absorb all its richest particles.

The cattle in the fold-yard should never be without a sufficiency of good water: this, as has been already stated, may be procured in various ways. Troughs placed in the walls, which of course in those places must be lower, is perhaps the best mode of presenting the water to the cattle in the yards; in this position they will also serve for the stable horses. In some cases, a stream of water may be conveyed through the farm-yard; when this is the case, below the place where the cattle drink, it may have conveyed into it the overflowings and drainings of the yards and offices, after they have been filtered through the earth and peat, and thus enriched, be conducted to adjoining meadows, and as much ground watered with it as it is capable of flooding.

In many parts of England the cheap mode of enriching grass grounds, by flooding, is wholly neglected. We see brooks and rivers loaded with the finest particles of the earth, and even the essence of dunghills draining from them as black and thick as treacle, and flowing neglected into a ditch or brook, where it is washed away and totally lost. Whereas, in other parts of England, the flooding of meadows has all that attention paid to it, which it so highly deserves. Every stream and even temporary current, in times of floods, are arrested in their course, and made to deposit upon the meadows all the rich particles with which they are loaded. Were this practice general, and as many of the running waters in this island, as are possessed of a fertilizing quality, diverted out of their beds or courses, and conveyed over as much ground as they are capable of flooding, this would, I am persuaded, be one of the greatest improvements of which this country is capable. Although but slightly connected with my main design, I have been irresistibly drawn to say a few words on the subject of irrigation, having practically known its importance in fertilizing grass ground,

and knowing also, that few men who reside in counties where this mode of improvement is not common, can be made to believe that irrigation can effect so much as to double the value of the ground.

Art. 4. *Cow-house, Feeding-house or Shed, Foddering-bay, Bull-house, Calf-house, Hay-room, Store or Turnip-room, Turnip-cistern, and place for Sick Cattle.*—If cows be kept very warm, this induces a tenderness which renders them susceptible of many diseases, to which they would have been much less liable had they been kept less warm. If cow-houses are floored over, the floor ought not to be of much less height than eight feet, and when this is the case, small openings for the purpose of ventilation should be left in the external walls, on a level with the underside of the loft, and on the opposite side to the door or gate. Such as are not floored over, but left open to the roof, are allowed to be the best, as the contaminated air has room to ascend high above the cattle, where it may escape through openings left in the roof for that purpose: thus constructed, the cattle therein, whether for the dairy or shambles, will enjoy that pure air and moderate degree of warmth which are most condusive to their health and comfort, and the owner's profit, especially if, on the side next the fold-yard, there be open gates instead of doors. No cow or feeding-house should be built without a passage or foddering-bay at the heads of the cattle: if that be wanting, it not only takes more time to feed the cattle and clean their troughs, but also their food is liable to be soiled by their dung when passing behind them; this renders it highly disgusting to them, which is the cause of much waste. The width of the foddering-bay need not be more than four feet, unless it be also used as a store-room; in that case, it may sometimes be necessary to make it eight feet wide. One foddering-bay may serve for two rows of cows, and it should have at least one large gate or door, so that turnips, &c. may be tilted from the cart or waggon upon the floor. Half-doors, four feet high, instead of close doors to the top of the openings, are preferred by some farmers, for the side next the fold-yard. For fattening cattle, gates are better than doors.

If the large gate or door be at the back, a smaller door will be necessary next the yard, to throw the tops and tails of the turnips to the young cattle, unless cows or young cattle be on one side of the bay, and the fattening cattle on the other side, when the tops and tails can be given to the former, and the turnips to the latter. If the foddering-bays have large doors on both sides of the building, it may be used as a covered gateway, where carts and waggons may stand loaded occasionally. If the rick-yard be at the back of the cow or feeding-houses, the door at the back will be convenient for taking in hay. A door at the end or back of the cow-house, will also be found convenient to turn the cows out to a meadow, without driving them through the fold-yard, where they would mix and fight with the other cattle.

Where a command of running water can be obtained, I recommend that a cistern should be constructed in the foddering-bay; in this case, if the turnips be topped and tailed in the field, when they are brought home the cart may be so placed as to tilt the turnips into the cistern: by stirring them a very little in the water all the earth that adheres to them speedily drops off, and leaves them perfectly clean: they may then be taken out of the cistern as wanted, by means of a scoop with a long handle; the scoop is made of iron, having a circular bow, with small bars in the form of different circular arcs, parallel to each other. The chord of the largest arched bar being the diameter of the bow. The bars are about two inches distance from each other. By this mode, the cattle are more speedily fed with turnips than in any other way, and they fatten much faster with clean turnips. The earth upon unwashed turnips scours the cattle, and keeps their bodies too loose and open; their dung being thin and almost liquid, carries off with it a white mucous matter from the bowels, which is frequently seen among the dung, the loss of which must necessarily retard the fattening of the cattle; but with washed turnips, their dung is wax-like, and figured similar to the dung of cattle fed on rich meadow hay. These cisterns are also found very useful in frosty weather, for when

frozen turnips are thrown into spring water, it speedily draws out of them all the icy particles, which, when retained, must undoubtedly render them much less nourishing and improving to the cattle that eat them.

The stalls or standings for cattle tied up, were formerly made six feet wide and eleven feet long for two cows; but now seven feet wide and twelve feet long, for two of the improved breed of large cattle, is considered necessary; these dimensions are the least that should be given, but if the standings are made somewhat larger they will be improved, only it must be observed they will be more expensive, and that, with many, 10 or 20 per cent. is a consideration. A building as fig. 1, 16 feet wide and 28 feet long, will contain eight cattle in four stalls, leaving a foddering bay four feet wide at their heads. A building 14 feet wide, and 32 feet long, (see fig. 2) will also contain eight cattle in four stalls, leaving a foddering bay of eight feet wide across the middle of it. In this last it will be evident the cattle will be more readily foddered, and besides the wide bay will serve as a place for stowing turnips, hay, or other provender, which could not be conveniently placed in the long narrow bay, as shewn by fig. 1. The area of each of these buildings is the same, but the circumference of fig. 2, is four feet more than fig. 1.

FIG. 1.

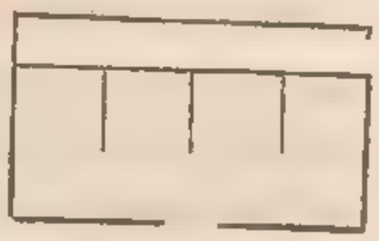
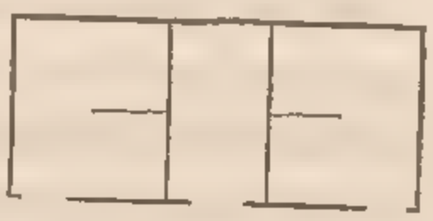


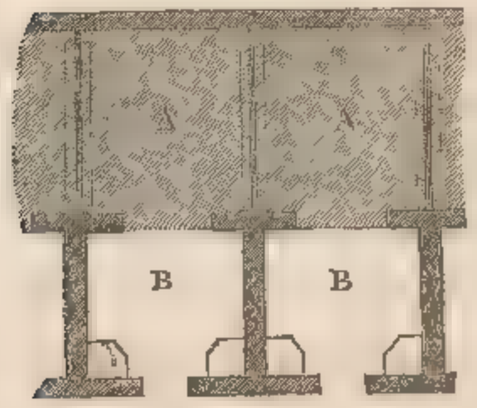
FIG. 2.



It is, however, found that bullocks will not fatten so fast when tied up in stalls, as they will when loose, in a good well-littered farm-yard open to the sun, and with sheds for shelter for them in bad weather; but it is said when cattle are loose, they cannot be so regularly fed or minutely attended to, and that the strongest or most forward will eat more than their proportion, while the weakest or timid, will not get what is necessary for them. Cows and heifers that are to be fattened, and have not been previously bulled, should be tied up to prevent their teazing each other, which greatly retards their improvement.

In some places in Scotland, the feeding byres for the loose cattle are constructed in the form of pig-sties, with a separate shed and yard for two cattle.

FIG. 3.



Two of these are shewn in fig. 3. The spaces A A, are each 15 feet by 13, and are roofed; and the spaces B B, are open yards 12 feet square, with fence walls. On a low partition or wall between A and B, is placed the rack for hay or straw for the cattle on each side, and in each angle of the open yards, on each side of the gates to B and B, are placed the troughs for turnips, &c., one trough for each beast. Each beast in this way requires nearly double the covered space of the preceding methods, with the addition of half of each enclosed yard, and without the advantage of a store-place, as shewn in fig. 2. The hay or straw might be put into the racks through openings in the back wall, or through openings above, if floored over.

When a cow-house is without a foddering bay, and the heads of the cattle are against an external wall, sometimes openings are made in that wall, through which they are supplied with turnips, &c. One opening will serve for two cattle, and there should be a door or flap to each, which is usually hinged at the top, and there is also a hook or stay to support it when opened.

Calves ought not to be within sight of the cows, but sometimes for convenience they ought to be near the cow-house. Rearing calves have generally been allowed to run loose, and many of them together in the house in which they were kept, till turned out to grass. These rooms were frequently littered, but the soiled straw seldom taken away. On the borders of the Tees, in the counties of York and Durham, where the finest short-horned cattle have been bred, whether as great milkers or quick feeders, or as possessing both these properties, a much better plan has been adopted by the breeders of improved stock, which is to tie the calves up as large cattle are tied, with a

rack and manger at their heads, and daily to clean away their dung and the wet straw. A building eight feet wide within, with stalls four feet wide, for the standing of two calves, is much preferred to the old method. The calves are thus not only kept much cleaner and drier, and served with much more ease and accuracy, but they are also prevented from sucking and injuring each other. When they have been tied up thus while young, they are sooner reconciled to such restraint when grown up; but it is to be observed, that they have not in this way sufficient exercise, and that their legs must have a tendency to get stiff. When several calves are loose in the same room, the person who serves them can feed only one at a time, and is obliged to beat off all the rest with a stick, the injudicious strokes of which frequently injure the calves materially, and sometimes fatally. In some places, the feeding calves are penned up without the least liberty of turning. A loose box or room, about six feet by seven feet, would be preferable, if expence were not a consideration. This mode is adopted near London by those who feed calves for veal.

Besides the foregoing conveniences, a separate house for a bull, where one is kept, is desirable, as well as a house for sick cattle; this last should have a door at the back, that they may occasionally be turned into an adjoining field or paddock, without passing through the fold-yard.

Art. 5. *Stable, Stable-court, Hay and Chaff-room, Loose Box or House, and Harness-room.*—The quantity of stabling will depend on the nature of the soil, the description of the farm, and also according to the manner in which the horses stand. If the horses are tied up without stalls, the least room will be required; with short stalls, a little more room; with long stalls, still more room; and if the horses be in loose boxes, most room will be wanted. Recesses may frequently be conveniently formed in the walls of stables, by which the projections of corn-bins may be much reduced, and in which pails, forks, and various other requisites, may be placed entirely out of the way. The short partitions between stalls ought to be three feet six inches, or four feet, and in

height about seven feet. The width of stalls, with short partitions, may be about four feet six inches. The long partitions to stalls, should be about eight feet, and the width of each stall from five feet six to six feet.

In the north of Yorkshire, some stables are divided into what are there called boxes, or separate rooms, in which the horses are loose, and can turn about at pleasure. Horses will lie down in these boxes, that would seldom lie down when tied with other horses, either with or without stalls. By lying more, and lying easier, they have seldom a swelled leg or a cracked heel. They are also much safer than other stables for mares and their foals. These boxes are of a proper size, when made eight feet wide and twelve feet long. A stable that is sixteen feet wide, and thirty-two feet long, will contain four of these boxes, leaving a passage of eight feet wide between them. The boxes are divided from the passage by tall paling, and a paled wicket to each. In these boxes the mangers are placed across the angles, next the divisions of the boxes, and are one foot ten inches across from the front into the angle. The racks are in form of quarters of circles of two feet radius, and are placed in the angles formed by the walls.

The hay and chaff are best kept in a separate room. The corn-chests should be large enough to hold sufficient corn for a week. As two sets of harness are requisite, one for the field, the other for the road, the one in use may hang on the pegs behind the horses; and if there be an harness-room, the other may be placed there. The harness-room for the saddle-horse stable should have a chimney and stove, to air it occasionally in damp weather.

The height of the walls of stables, between the pavement and the loft or ceiling, should be eight feet at the least, and the inside of these ought to be built of brick, particularly if the stone be of that nature to attract dampness. For draught-horses, a stable open into the roof is better than with a loft over it; but a stable ceiled over, at eight feet high, is better for saddle-horses, if properly ventilated, as they require a warmer stable than draught-horses.

Lofts over stables are bad places for both hay and corn, as these articles, in that situation, must be more or less impregnated with the noisome effluvia arising from the stale and dung, as well as from the breath of the horses, thereby diminishing the nutritive qualities of the food, and occasioning disgust to the animals that eat it. The health of horses is greatly promoted, by judiciously ventilating the stables in which they are kept. A small opening should be left between the bottom of the stable-door and the sill; or a hole made in the door near the bottom, of about six or eight inches square, with a slide to cover it, in part or in whole, when the weather is cold. If there be a loft over the stable, openings about three inches by four should be left in the external wall, above the heads of the horses, near the ceiling; through these openings, the impure air will be driven out by the pure air admitted through the door and windows, and by these means the stables may, at all times, be kept in a state of ventilation. If there be no loft over, the openings may be in the roof. The stable windows should be made with broad upright bars, and openings left between them, which openings are covered or left open, by means of a sliding frame within, having similar upright bars and openings. Above this frame should be a glazed light, it being injurious to the eyes of horses to be kept in dark stables. Stable doors, as well as the small doors of barns, cow-houses, &c. are frequently made in two heights, so that the upper half may be kept open, while the lower half is shut; this is frequently desirable to admit additional light or air, and at the same time prevent the entrance or exit of cattle or pigs. Great care should be taken to have stables well paved, so that the urine may run clean off. When badly paved, the urine lodges in holes, where it soon corrupts and becomes exceedingly offensive, occasioning blindness, farcy, glanders, and other diseases. These, and other bad effects, may be occasioned if the stable be too near the privy, pigsty, or hen-roost. It may be proper here to state, that before horses are taken up into the stable in autumn, it is advisable to keep them about a fortnight in a farm-yard, wherein are lofty

and open sheds, in order that the change from cold pastures to warm stables may be gradual.

Art. 6. *The Cart-shed or Waggon-hovel, Plough and Harrow-place, and Wool-room.*—The cart-shed or waggon-hovel ought to be so placed, that it must be passed in going to and from the stable, otherwise the carts or waggons will be frequently left standing out. These, of course, must be varied in dimensions, according to the customs of the place. If carts be used, the building need not be so wide as where waggons are used. The roof and wall in front, above the openings, may either be supported by posts and brest-summers, small brestsummers with struts, or with brick or stone piers and brestsummers or arches. The choice of these several methods will depend on the nature of the materials to be used, and on the amount of expence to be incurred. The height should be at least seven feet, and for covered carts or waggons it should be higher. If piers be built, the space behind them, and between the waggons and carts, may be appropriated for ploughs or harrows. If the front be supported by posts, as there will be no room between the carts or waggons, a space at one end may be prepared for the harrows and ploughs, if there be no other shed, for rollers and these purposes.

The operation of backing a waggon or cart, is like a battering ram applied to any thing with which it may come in contact. Thus the back wall will be in danger of being battered down, unless a bank of earth, or some other obstacle, be put to stop the wheels. It will also be necessary to have spurs or stones to the posts or piers, to keep off the wheels; and, indeed, all gate-posts or angles of buildings where carts or waggons pass, should be thus protected.

When it is necessary to load a waggon over night with corn, &c., it may be requisite to have doors at least to one division of the hovel, where it may be locked-up. The barn, if with large doors, as has already been stated, may be used for this purpose. Part of the cart or waggon-hovel, if conveniently near the feeding-house, may occasionally be used for a store of turnips, &c.

Over the waggon or cart-lodge may be the granary. The granary floor may be supported by posts placed behind, and in a line with, the piers or exterior posts. These posts, thus placed, will not be in the way in putting in the waggons or carts, and cannot be in more danger of being displaced by the carelessness of the carter, than the exterior posts which they would relieve. When the granary floor is supported in this way, it will require much less of both materials and labour, than if supported by girders or trussed framing. The loft over the waggon or cart-shed may, in part, be appropriated for other purposes as a wool-room, implement-room for rakes, forks, sacks, &c.

Art. 7. *Hog-sties, Hen-roosts, &c.*—These should be placed conveniently near the house, but sufficiently far off that the smell may not be perceptible there. It is desirable to avoid passing through the fold-yards to the pig-sties, or even to feed the store-pigs in the yards. Instead of having shoots through the walls for conveying the pigs' food into the troughs, in some places an opening is left in the wall of the length of the trough, which is placed at the bottom of the opening, with a door over it, hinged to a rail, or working in centres, at or near the top of the wall. When the pigs are fed, or their troughs cleaned out, the bottom of this door is pushed inwards, and when the pigs are eating their food, they push it outwards. Reveals or stops are formed to prevent the door swinging too far either way. By means of a bolt, on either hand, on the outside of the door, it may be fixed towards the inside when cleaning out the troughs, and towards the outside when the pigs are to eat. Objections are made to this method, as the troughs cannot conveniently, in this way, be so long as they are frequently made; on the other hand, it is stated, that when the troughs are long, the larger pigs not unfrequently stand in them, to the exclusion of the smaller ones, and that it is better to have two or three short troughs than one very long one. The hog-sties should always be large and commodious, and the hen-roosts may be over them: the height to the plate of the roof may be three feet six inches. Some recommend feeding pigs in cots so

close that they cannot turn. Near the hog-sties should be a place for a boiler, and also for their dry food, and, in a convenient place, a tank should be formed for the hogs'-wash. If geese or ducks be kept, and if a space be left between the pig-sties, they may thus be placed conveniently under the place for the hens. The pigeon-house or dove-cote, may be placed over almost any building, as the coal-house, cheese-press-house, workshop, store-room, &c.; but if the water collected from the roofs be used for culinary purposes, pigeons ought not to be kept, as they dirty it; unless, indeed, the sand filter be found capable of purifying such water.

Art. 8.—*Brining-room for Wheat, and Slaughter-house.*—Separate buildings are perhaps never required solely for these purposes. These operations may be performed in other buildings, or if buildings have these names, they may also be used for other purposes. The floor for a brining-room should be constructed of brick, or flat paving stones. The flint and pebble paving of stables, in consequence of the many holes, is not well adapted for this purpose.

Art. 9. *Sheep-house.*—A house twenty feet square will contain thirty sheep, and ought to be eight or ten feet high; this allows thirteen and a half feet superficial to each sheep. The doors to a sheep-house ought to be always open, and there should be a fold-yard, that the sheep may, at their pleasure, be either in or out. A house expressly for this purpose seldom enters into the arrangement of the homestead.

Art. 10.—*Forge, Tool-house, Workshop, &c.*—One building may be appropriated for all these purposes; but should the whole not be required, a smaller room will be sufficient. The workshop ought to have folding-doors to admit a cart or waggon. In some situations, a forge for shoeing cart horses, and sharpening plough irons, is found very convenient. A privy should be placed in some convenient situation, at the back of the out-offices, for the men.

Art. 11. *Cottage or Bothey, and Meal-Girnal,* are sometimes attached to the farm-yard buildings in Scotland. The bothey is the place where the men sleep, and prepare and eat their oatmeal and potatoes. One room, about seventeen feet by fifteen feet, generally answers for all the men for these purposes. The meal-girnal is the repository for the oatmeal previously to its being distributed to the men, which is usually given to them weekly.

CHAPTER V.

ON THE MATERIALS AND CONSTRUCTION OF AGRICULTURAL BUILDINGS.

SECTION I.

ON MORTAR.

ONE principal cause of the speedy decay of modern buildings is bad mortar. Bad mortar is frequently owing to the little care that is taken to procure good materials, and perhaps more frequently to the want of care in proportioning and mixing them together. This last business ought not to be left, as it too generally is, to the discretion of any common labourer. That so little care is taken to provide good mortar, is, perhaps, greatly owing to an erroneous opinion very generally entertained, that the ancient art of making strong and durable mortar is lost. Although the Romans are allowed to have excelled in this art, yet it may be questioned whether they knew much more of it than is come down to us in the works of Vitruvius and Pliny. We may at least suppose, that the methods of making mortar which they describe, were those most generally practised by the best architects, when they wrote. These differ from the present common practice, chiefly in two particulars; a greater proportion of sand was mixed with the lime, and pounded bricks added to the composition. If we may judge of the private buildings of the Romans, from what Seneca says in his ninth Epistle, they were not more durable than modern buildings. He says, "I was the other day at my villa, and complaining of my charge of

repairs; my bailiff told me it was none of his fault, for the house was old, and he had much to do to keep it from falling on his head. Well, thought I, and what am I myself then, who saw the laying of the first stone." As to the public buildings of the Romans remaining in this island, the mortar in them appears to have been made after the above-mentioned method, being composed in part of pounded bricks.* This mortar is of a dusky red colour, but what I have seen is not at all harder than the mortar in many works of later ages, particularly on the thick walls of some old castles, and other buildings, that have been grouted. Walls of brick or stone are said to be grouted, when the vacuities in the interior of the walls are filled with mortar sufficiently fluid to be poured out of a bucket. To these two circumstances chiefly, namely, thick walls and fluid mortar, may be attributed the superior hardness of the mortar in many ancient buildings. When mortar is in a fluid state, we can more readily mix the lime and sand together, than when it is in the state of paste. And thick walls necessarily cause the mortar to be long in drying, and the longer it is in drying the harder it becomes.

The first step towards making good mortar is to procure good materials. But in order to do this with judgment, it will be previously necessary to know some, at least, of the causes of the induration of mortar: we shall, therefore, make a few observations of the nature of the materials of which it is composed.

Of Quick Lime.—In Britain, lime is obtained by burning chalk, and different kinds of limestone. Some of the latter are very coarse and impure,

* The outer walls of Pevensey Castle, in Sussex, and the octagonal tower in Dover Castle, are said to be of Roman construction, and they have been built with this kind of mortar.—Mr. White says, that whether clay be burned to such a degree as to produce complete vitrifaction or perfect dross, in either state it is an inferior material to enter into the composition of mortar; and that it appeared to be best for this purpose, when a chalky clay was so indurated by fire, as to put on the appearance of commencing vitrifaction.

and some approach nearly to the fineness of marble. Limestone and chalk, when pure, consist of only calcareous earth and fixed air, or carbonic acid gas. Perfect calcination expels all the fixed air from calcareous substances, and thus converts them into quick lime, but the quick lime will receive again nearly all its fixed air on being exposed to the atmosphere for a sufficient time; it then becomes mild or dead, as it is commonly called, and has then lost its power as a cement. Lime for mortar is seldom *sufficiently burned to expel all its fixed air*, and is often left much too long exposed to the atmosphere before it is mixed up with the sand; it frequently happens also, that the mixture is imperfectly made, and left long exposed after it is made: when any of these circumstances take place in any degree, the strength of the mortar will be proportionably diminished.

The use of lime in mortar, is to fill up the hollow spaces or vacuities between the grains of sand, and to cement them together, thereby forming a kind of artificial stone: to add any more lime than is sufficient to fill up these spaces seems to be useless, but to add much more must weaken the mortar; but, if too little lime be used, there will be cavities left between some of the grains of sand, and the mortar will consequently be short or brittle; therefore, when we cannot ascertain the best proportions of lime and sand, it is better to use too much lime than too little.

It has been observed above, that limestone and chalk, when pure, consist of calcareous earth and carbonic acid gas only; but they are rarely found in a pure state, having generally more or less of clay, sand, iron, magnesia, &c. mixed with them. Impure lime is rarely of a clear white, but is either of a dingy grey, brown, or buff colour; and such is generally preferred, to pure white lime, for mortar. This dark colour is chiefly owing to iron, and iron contributes greatly to the strength of mortar. Mr. Smeaton says, he found the best limes for water cements, contained a portion of clay. Near Tunbridge, in Kent, there is a poor limestone which contains so much sand, that the lime from it makes a very strong mortar, without any sand added to it; but the more sand the stone

contains, the heavier it will be when burnt, and the less will be the quantity of powder produced on slacking it, because, sand loses little if any of its weight in the fire, and does not swell at all when the lime is slacked. The chief advantage in using such limestone, is its having the sand in it already completely mixed with the calcareous earth, but to obtain this advantage, we must be at the useless expence of burning the sand.

Marbles are said to owe their colours chiefly to iron. Some have been found that contain five per cent. of this metal. Tarras and Puzzolani are rich in iron, and mortar which contains a portion of either of these ingredients, will set very hard even in water. But that which is called roman-cement, probably excels them. A cistern, built of bricks or stones, and lined with a coat of mortar made with roman-cement, will be perfectly water-tight, and is, in some respects, preferable to a lead cistern, besides being much cheaper.

In many limestone quarries, there are several strata of stone differing greatly in quality. When this is the case, it will be prudent to ascertain the component parts of each stratum by analyzing them, and to assort the strata according to their different natures, burning the purest for manure, and the impure for mortar, if it be found to make a strong cement.

Of Sand, and the Proportion to be used.—With foul and dirty sand, it is impossible to make good mortar. If the sand have unburnt clay mixed among it, or any kind of tender, friable, substances, the mortar must be weak and crumbly. It is evident that mortar can never become harder than the particles of matter cemented together by the lime. Sand, dug from pits, is seldom without a mixture of mould or clay, which, being unburnt, is very injurious to mortar. River sand being sometimes found clean washed to one's hands, it is, on that account, preferable to most kinds of pit sand. With sea sand, it is said that a cement, equally strong with either of the other two, may be formed; but this kind of sand is improper to be used in building the walls of

dwelling-houses, and more so for plastering them, on account of the salts therein attracting the humidity of the air.

The proportion of sand which ought to be added to lime, to make good mortar, will vary according to the quality of the materials. To two measures, of some kinds of lime, three of sand may be added; to others, no more than a quantity of sand equal in measure to the lime in powder, and to others, still less. A greater proportion may be added, if the sand consists of a mixture of fine and coarse grains, than if it be either wholly fine or wholly coarse; and the proportion may be further increased, if a portion of small gravel enters into the composition, because the smaller grains slide in between the larger, and fill up in part those spaces, which, otherwise, must have been filled wholly with lime. I have observed the mortar in several places to be very good, which was made with a dusky yellow sand, dug from pits in which were fragments of iron stone.

Of Water.—Muddy water is improper for mortar, on account of the particles of mould or clay which it contains. All kinds, whether river, spring, or sea water, provided it be clear, may be equally good for making a strong cement; but salt water will be improper for mortar or plaster for dwelling-houses, for the like reason as is before-mentioned respecting sea sand.

Of making Mortar.—From the preceding observations, it would seem that, in order to make good mortar, we should procure thoroughly burnt lime, of that sort that falls down into a dusky grey, brown, or buff-coloured, powder. This should be fetched from the kiln whilst it is hot, and immediately slacked, and mixed with the proper quantity of clean sharp sand. This mixture should then be passed through a screen, not only for the purpose of cleaning it from coarse gravel and cores of limestone, but also for the purpose of mixing the lime and sand more completely together. When screened, add thereto water sufficient to enable you to bring the mixture to a moderate consistence, by

means of a shovel and beater. A cart or waggon load of lime may be thus mixed up at once, and it is supposed to improve by laying a few days close covered up. Small portions of this heap are successively tempered for the mason or bricklayer, until the whole is used. When tempering it, let the beating be continued till the mortar has got all the toughness that you find it will acquire by beating. The more the mortar is beaten, the more sand it will take in proportion to the lime; of course the saving of lime will pay for beating, to a certain extent. Much good beating is essential to good mortar

In some sorts of lime, when screened immediately after it is slacked, there are many cores which will not pass through the screen, but which will afterwards fall down into powder; but this powder will be unfit for mortar, in consequence of its carbonic acid gas being only partially expelled, yet it will be equally useful for manure; all that is necessary for agricultural purposes, being to give the limestone fire sufficient to make it slack and fall down into powder. As soon as lime is slacked for mortar, it is generally covered six inches thick with sand: this retains the heat long in the heap, and, by that means, causes clods of imperfectly burnt stone to slack, which otherwise would not. We may, by this means, increase the quantity of quick lime, but we reduce its power as a cement. Mortar, with a few coal ashes in its composition, will speedily acquire a considerable degree of hardness; and this hardness will be still further increased, if a few iron filings, or sweepings of forges, are added. Mortar, with these two ingredients in its composition, is of an excellent quality for pointing buildings: but it should be very much beaten before it is used. Good mortar will remain full and flush in the joints; it will neither crack, lose its original skin, nor become crumbly.

Being provided with mortar of the best quality, our next care is to see that the stones and bricks are in a proper state for walling; for if mortar be used along with such as are warm and dusty, as bricks always are when fetched hot from the kiln, the best mortar will be spoiled. Materials that are warm and

dusty greedily attract the moisture from the mortar, which then speedily sets; but, in that case, it is always short and brittle, and frequently unconnected with the materials of the wall. It is, therefore, a good practice, particularly in dry and hot weather, to water the materials before they are walled. This prevents the mortar, in which they are laid, from drying too speedily, and also causes it to lay firm hold of them.

Bad mortar is produced—

1st. By limestone being imperfectly burnt;

2nd. By lime lying long exposed to the air before it is mixed up;

3rd. By its being mixed up and used with many small particles, or cores of lime, unslacked;

4th. By the sand having among it a mixture of clay, unburnt, or mould: or finally,

5th. By lying too long exposed to the air before it is used.

Directions for using Roman Cement.—Procure sand, the sharpest and coarsest which can be got. It should be free from earth or clay, and if it cannot be found free from these, it must be washed till it is perfectly clean. The sand may be used with the cement, if it be damp; but it is much better to mix the cement and sand together, in a dry state, and add as much, but not more, clean water as is necessary to make it of a consistence fit for use. For stucco or building, the cement will bear to be mixed, three measures of sand to two of cement; but for stucco, there should not be a less quantity of sand than cement. Mix no more cement at a time than can be applied in ten minutes, otherwise it will be set before it can be all used, and after once set, it is no longer fit for use. If bricks are laid in cement they must be previously soaked in water, or the cement will not adhere permanently to them. If it be used for stone work, the stone should also be well watered. In laying stucco upon walls, great care must be taken to rake out all the loose mortar, whether of masonry or brick-work. For every purpose of plastering, the cement should

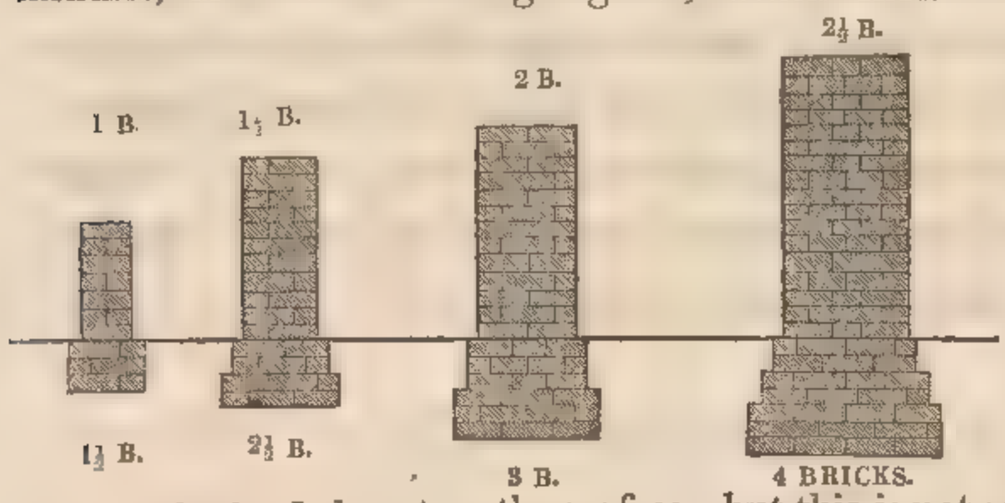
not be laid on of less thickness than three-quarters of an inch, and the whole thickness must be laid on at the same time; if it be laid on in two coats, the last coat will be subject to scale off from the first. In stuccoing walls, the workman must not attempt to cover more surface at a time, than he can float and finish in ten or fifteen minutes, and the edges where he has left off must be made rough and wet, before he joins fresh stucco to it.

SECTION II.

ON THE WALLS OF BUILDINGS.

IT is not necessary to say much on the materials for the construction of walls, as the facility of obtaining them, or the prices at which they may be procured, will, in most places, determine the choice; however, good bricks for the inside of the walls of dwelling-houses, granaries, and stables, are perhaps preferable to any other materials. The foundations of walls should vary in their thickness, according to the compressibility of the ground, and the height to which they are to be built, or the weight they may have to support. Under wide doors or windows, the weight of the walls is sometimes so much less than the piers, that, under those openings, the walls have little or no tendency to compress the ground; and no moderate foundation for the piers, would render the ground under them so little compressible. When this is the case, it is better to turn an inverted arch under each opening, with its springing under the piers. The foundations for gables, piers, and chimneys, ought to be thicker than either thinner or lower walls, and in all cases they should be contracted, or set off equally on both sides, in order that the walls may stand exactly over their

middles, as in the following figures, which shew foundations for brick walls of different thicknesses. Where any of the above circumstances have been neglected, the walls are frequently fractured. In some kinds of clay an apparently firm foundation



may be obtained almost on the surface; but this is not safe, even for fence walls or low buildings, as, in extreme dry weather, the ground will be dried and cracked to a considerable depth, which circumstance has produced injury to buildings which have stood without shewing any settlement for several years. If the foundations be only so far below the surface as to be out of the reach of the effects produced by frost or drought, and the nature of the soil in other respects should not require more, it will generally be found sufficiently deep for farm-buildings. These being for the most part low, the foundations are a considerable portion of the whole of the walls; and although it would be highly improper not to allow a sufficient foundation, yet to have but a few inches more than sufficient, in an extensive homestead, would greatly increase the cost. Besides what has been said, Chap. II. Sect. V. in preventing damp rising in walls, tarred paper or lead may be used.

External brick-walls for houses of one story, may be one brick in thickness; if two stories, the first may be one and a half brick thick, and the second one brick in thickness; if three stories, the first story two bricks, the second one and a half brick, and the third story one brick, or one brick and half, according to the weight of the roof to be supported. If the roof be narrow, the walls may be thinner than if the span of the roof be wide. The external walls of a building roofed at two spans, have only half the weight of the roof to support; but if roofed at one span, they have the whole weight to bear. The

walls for stables, barns, cow-houses, cattle-sheds, and fence walls, may be one brick thick, with piers one and a half brick thick, at from six to nine feet apart. If the barn be large, or the walls much higher than the other buildings, the walls may be a brick and a half thick. The walls of all smaller buildings need only be one brick thick. Brick and flint walls are never made less than one and a half brick in thickness, and this may be sufficient for all the above purposes, for the height of two stories. If the walls are stone, they may vary from one foot to two feet, according to the rates for the brick walls. The placing of windows and door frames in external walls in reveals, is seldom practised in many parts of the country. In London, it is enforced by the Building Act: it is certainly an improvement, and may be effected in every wall nine inches thick or above. Window sills are also very much neglected in country places, and when there is no substitute, if the walls are of brick, they suffer in consequence. These, where stone is expensive, or cannot be procured, may be formed of brick and roman cement, or they may be formed of wood, and painted.

The stability of walls constructed of brick and flint, depend much on the bond timbers. There ought also to be wood bricks, as they are termed, built in, where any thing is required to be fixed to the walls; and templets or plates should be laid under the ends of all timber resting in the walls, to spread the load. It is recommended, to prevent the injurious effects of mortar on these timbers, that they should be coated with some substance that should keep out the moisture of the mortar: some have recommended the ends of timbers resting in the walls to be bedded in loam, to prevent the injurious effects of the mortar. The late Mr. Carr, of York, said lime will preserve the timber better than loam. In some parts of this country, and also in France, where they build with stone, bond timbers are not used; bond timbers may be less necessary where the materials are large and well fitted together, and the walls will, of course, be more durable, if they can be avoided. It will be found economical in the topping of all walls exposed to the weather, whether of brick or stone, to set

the coping, or last course, in roman cement. A strong and durable bond, well calculated for some purposes, may be formed of bricks, or some kind of stone, by building a few courses in this manner. If this be occasionally done, less bond timber will be required. Brick walls that have been cracked from the top to the bottom, and repeatedly stopped, and the cracks as often re-appearing, have been effectually tied together by cutting out indents three courses of bricks broad, the width of the house, and also crossing the cracks at intervals, afterwards filling up the whole with new bricks well bedded in this cement. Bricks are very porous, and, in driving rains, will absorb a great quantity of water. To prevent this, an excellent coating is formed of Roman cement and clean sharp sand, but unadulterated with lime or other inferior materials; and when laid on the outside of brick walls, of a proper thickness, will be quite effectual. In this way it also forms an excellent skirting for rooms, with stone or brick floors, that are to be frequently washed, and where, if of wood, it would soon decay. The materials for making this cement may, probably, be found in many other parts of the country, either separately or collectively, besides those places where it is at present procured.

SECTION III.

ON THE STRENGTH OF TIMBER.

THERE is great diversity in the strength of different kinds of timber, and even of the same kind, according to the soil and climate in which it has grown, its age, and the part of the tree from which the timber is cut. The

wood next the bark, called the sap, is the weakest, and soonest decays. The wood immediately surrounding the pith is the next weakest, and this decreases in strength with the age of the tree; but the strength gradually increases as we recede from the pith towards the sap.

Timber cut from the lower part of the trunk of a tree, will be found stronger than that cut from its upper part, and this last is stronger than the branches. It seems that the strength of the different parts of the same tree bears some proportion to their respective thicknesses, and diminish as the parts diminish in thickness. Mr. Emmerson says, he found that some pieces of the same tree would not bear half the weight that others would bear. Timber is also weakened by knots, shakes, &c., and when it happens to be cut across the grain, in sawing it into scantlings, it will be weakened more or less, accordingly as it happens to be cut more or less across the grain. Great allowance for strength should, therefore, be made in timbers for building; and we ought to make them so strong as to be able to bear, without breaking, three or four times the weight intended to be laid upon them.

The strongest kinds of timber are not always the best for building; thus ash, which is both stronger and tougher than either oak or Memel fir, is by no means so stiff as either, as it will bend with a much less weight, therefore not so well adapted as those timbers, on this account, for the construction of floors, roofs, &c.

The stiffest and strongest beams or scantlings, to be used as joists, purlins, &c., that may be cut out of round trees, are not those which contain the greatest quantity of timber. The stiffest beam is that whose breadth is equal to half the diameter, or the radius of the tree, or is equal to the side of the hexagon it would form, and the depth the distance between the opposite sides. The strongest beam is that whose depth being squared, and multiplied by its breadth, is the greatest possible. If the diameter of the tree be divided into nine parts, the

depth of the strongest beam will be seven parts and near four-tenths of one of those parts, and the breadth five parts and nearly two-tenths of a part.

Pillars or posts of whatever scantling, particularly when they are long, are greatly relieved by stays or strutts, as are also breastsummers; these last, to cattle sheds, waggon hovels, &c. may be of small dimensions, if they are strengthened by shortening their bearings with strutts.

Strutts, pillars, &c. that have no cross or transverse strain, may have their sections square, or as nearly so as other circumstances will admit.

Mathematicians and engineers, of much celebrity, have employed themselves in investigating the strength of timber. They have furnished us with rules by which we can calculate what timbers, of various kinds, and any length, breadth, and thickness, will support with safety. They have taught us to economize timber, by giving to every scantling, according to its destination, that precise form which is best adapted for enabling it to support its load. Such other results and observations, respecting this most interesting subject, as are necessary for erecting buildings similar to the accompanying designs, are collected in the two following sections.

SECTION IV.

ON THE CONSTRUCTION OF FLOORS.

IT has been ascertained that the strength and stiffness of a joist, depends more upon its depth than its breadth; being always strongest and stiffest when laid upon its edge, that is, when the depth is the greatest. This fact is very little attended to by many country carpenters, as they very frequently, for no

reason whatever, put it the contrary way. Now a piece of timber of any length, say ten feet, and its scantling four inches by two inches, will carry double the weight when laid upon its edge, that it will do when laid upon its side. If the scantling be six inches by two inches, when laid on its edge, it will bear three times the load that it would carry if laid on its side; and if the scantling be eight inches by two inches, it will carry four times as much when laid on the edge, as on the side. The rule for ascertaining the comparative strength of a joist laid on its edge or on its side, is

"The square of the depth multiplied by the breadth."

Thus, for the last example, when laid on its edge, eight inches is the depth, this being squared or multiplied by eight, and the product multiplied by two, which is the breadth, the last product will be 128; but, if laid on its side, then two inches is the depth, which being squared or multiplied by two, and the product multiplied by eight, which is now the breadth, the last product will be 32, only one-fourth of 128. If one piece of timber be of the same breadth and length as another piece of the same kind of timber, but the last double the depth of the first, that which has the greatest depth, will be four times as strong as the other. If the greater depth be three times the other, it will be nine times the strength. But the depth of a joist may so far exceed its breadth, that, owing to its thinness, it will warp or twist, and in that case, much of its strength will be lost. When the joists are thin, they may be greatly strengthened, by putting strutts between them, to prevent their warping or twisting; there may be one or more rows of these strutts, and they should be continued from one side to the other side of the room, and between the last joists and the walls. Some use short ends of boards for this purpose, others use fillets of wood. When fillets or slips of wood are used, they are cut of such lengths that one end may be nailed to the side of one joist, near its lower edge, and the other end is nailed to the side of the adjoining joist, near its upper edge;

another piece is then placed between the same joists, and against the first piece, the reverse way, crossing the direction of the former. This operation is called herring-boning. Either of these methods are less expensive, and as effectual, as framing the strutts into the joists. Before putting in the strutts, a slip of wood may be nailed upon the top of the joists, to keep the joists in their places. When the floor is laid, and the ceiling lathed, the joists will be effectually tied together, and the strutts will have no tendency to push out the walls. Two inches is a proper thickness for a common joist, if thicker, the quantity of timber is unnecessarily increased; and if thinner, they are liable to split, by nailing the flooring boards to them. Trimming joists, when they cannot be deeper than the common joists, should be two inches and half, or three inches broad, according to the number of common joists they support.

The strength of a joist of any length and scantling, say eight feet long, and six inches deep by two inches broad, is double the strength of one sixteen feet long, of the same description of timber, and of the same scantlings; that is,

"Their strengths are inversely as their lengths."

But the long joists may have double the load to support that the short joists have. For example, suppose a granary floor having joists six inches deep, and two inches broad, with a bearing of eight feet; and suppose another with the bearing of the joists sixteen feet, and the joists two inches thick, to carry double the load of the short joists, which will be the case, if the corn upon both floors be of the same depth, the long joists must be at least twelve inches deep.

A girder sixteen feet bearing, supporting joists of twelve feet long on each side of it, for a stable loft, may be twelve inches deep and ten inches broad; but if it be supported in the middle by a stall-post, each half will have only half the load to support, and as the bearing is reduced one-half, it will require to be only one-fourth of the strength, or about eight inches deep by five and a half inches

broad, or little more than one-third of the timber. If the space on each side of the girder be only nine feet it will have one-third less floor to support, and instead of the girder being twelve inches deep by ten inches broad, it may be eleven inches by nine inches; and if this be supported by a stall-post, it will, as before, be required only one-fourth of the strength, or seven by five and a half inches. If the girder lie in the direction of the length of the stable and bridge over, and be supported by all the stall-posts, it may be of still smaller dimensions. Again, suppose a granary-floor require a girder with a bearing of twenty-two feet, supporting joists eight feet long on each side of it, to be fourteen inches deep and twelve inches broad, and that it is over a waggon-hovel, and might be supported by posts; suppose two posts, and those so placed as to divide the bearing of the girder into three equal parts. Each third part of the girder would now have only one-third of the load to support; and, as the bearing is reduced two-thirds, it is only required to be one-ninth of the strength, or seven by five and one-third; or, requires less than one-fourth of the timber. Girders of large dimensions, in agricultural buildings, are seldom required, and might, perhaps much better, on all occasions, be avoided. What is called trussing of girders, is now generally considered to be of very little or no use. If a girder be of large dimensions it should be sawn down the middle, to ascertain whether it be sound in the centre. If it prove sound, the two pieces may be bolted together with slips of wood between them; in doing so, it is usual to turn the sawn sides outwards. To ascertain whether the timber be sound or not, is not the only advantage of opening it; as, by this means, it will also dry sooner, and be less likely to decay.

When the depth of a beam is not confined, the strength may be greatly increased by making it of less width and greater depth. The depth may be increased to any extent by adding one or more pieces above another. If two pieces be joined together in this way, they should be equal, or nearly equal, in depth; and they should be joggled, or keyed, or indented, and either bolted

or strapped together with iron hoops. The several abutments are more likely to be perfect with keys than indents, and the keys should be made in two wedge-formed pieces, of dry and hard wood; but the space in the beams for these should be parallel, and cut equally into both beams. See fig.

When mortices are made in girders or beams they should be as near as possible in the middles of the depth, but there ought not to be any in the middle of the length if it can be avoided. It is better, however, that there should not be any mortices; and, if the depth will not allow of the joists resting on or bridging over the beams, they may be supported and connected with the beam by iron stirrups. When joists are tenanted into girders their whole depth is not supported; and any weight coming suddenly upon them, as a sack of corn pitched from the back of a man upon a granary floor, they will be split immediately under the tennon, and this split will extend sometimes nearly the whole length of the joists, reducing its strength more than one-half.

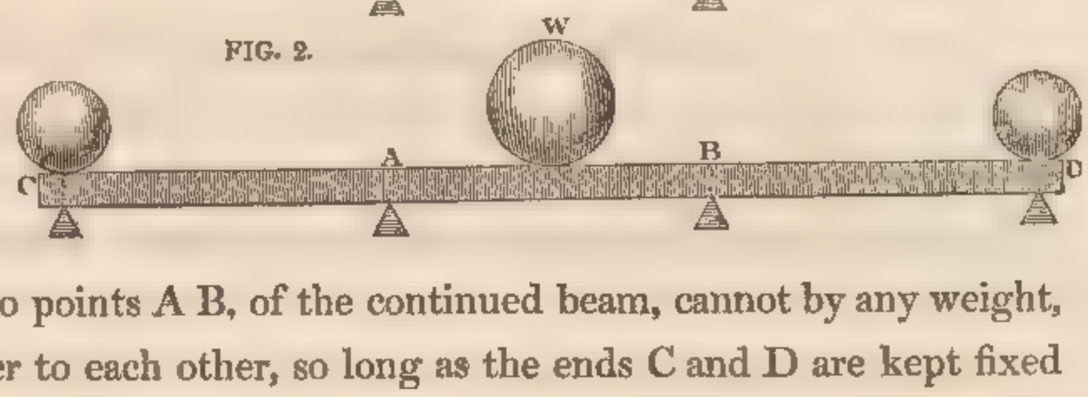
If a girder in a building has sunk in the middle, cut it across there about one-third through, on the upper side, with a saw, in two, three, or more places, at equal distances, and then raise it, either by means of shores and wedges, or a screw, till it is straight or rather camber on the upper side. When this is done, drive wedges of hard wood firmly into the saw kerfs.

When a piece of timber is firmly fixed at both ends, it will be much stronger than when the ends are loose; and all timbers, as joists, purlins, or rafters, that are long and pass over many supports, are double the strength of short pieces framed between, or lying loose, and only extending from one support to the other.

Fig. 1. Has its ends loose. The effect of a weight, W, placed upon this, is to make the lower edge convex, and the upper concave; the lower part of of the beam being extended, and the upper compressed; for if the beam be bent, the two points *a b* will be brought nearer to each other.

FIG 1.

FIG. 2.



Now in fig. 2, the two points A B, of the continued beam, cannot by any weight, W, be brought nearer to each other, so long as the ends C and D are kept fixed down. Therefore, if the beam be bent between A B, the whole must be extended, and the difference of the strength appears to arise from this circumstance, that in this the strain is of one kind only, namely, extension; while, in the other case, there are two kinds of strains, viz. compression and extension.

In all cases where the ends of timbers are inserted in the walls, they should be left open until both the walls and timbers are dry.

Ceiling joists need not be more than an inch and three quarters thick if nothing but the laths are nailed to them; when properly put up, they should be hollow on the under side, and, if put up in short pieces, their ends should rest firmly against each other, and also against the walls. Thus a flat arch is formed by them, which, as long as the butments remain good, is sufficient to carry all the ceiling materials, and even, in some degree, to stiffen the floor above. In this way the ceiling can have no tendency to crack by any load on the floor above; but, if the ceiling be perfectly straight or convex, any weight on the floor above will extend it, and thus produce cracks. If there are no ties to the walls in the direction of the ceiling-joists, diagonal pieces should be introduced, to prevent the ends of the ceiling-joists pushing out the walls.

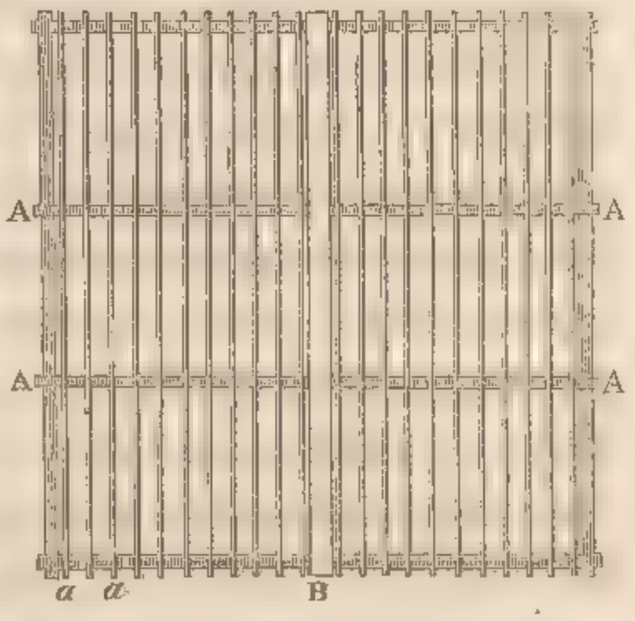
The edge of a joist that is rounding should be the upper edge, and the

hollow one the lower edge. It would not, however, be proper to cut them at all across the grain to make them thus. If they are not naturally hollow on the lower, and round on the upper edge, to make them sufficiently so, fillets or slips of wood may be nailed to them.

There are three modes of framing floors; the one with common joists only, the other with girders and common joists, and the third with girders binding, and bridging joists. If the floors are wide, and are to be framed of ordinary oak, or any other kind of knotty and cross-grained timber, girders will be necessary; but fir timber, in single joists, is far preferable for this purpose for farm-houses, and in most places, in consequence of the extra expense of sawing, and other labour, if harder wood be used, fir will be found the cheapest. The best joists should be in the middle of the floor; if any prove a little faulty or thinner than the rest, they should be placed next the walls. When there is only one girder across a room, and common joists, the girder bears half the weight of the floor. If there are two girders, each girder bears one-third, if the bearings of the joists are equal.

When there are two binding joists, as A, A, A, A, in fig. 1, on each side of a girder, B, the girder has only one-third of the weight of the floor to support; for, each two binding joists bear two-thirds of the weight of the bridging joists, *a a*, &c., and, consequently, the girder bears only half the weight that is laid upon the bridging joists; that is the half of two-thirds, which is one-third.

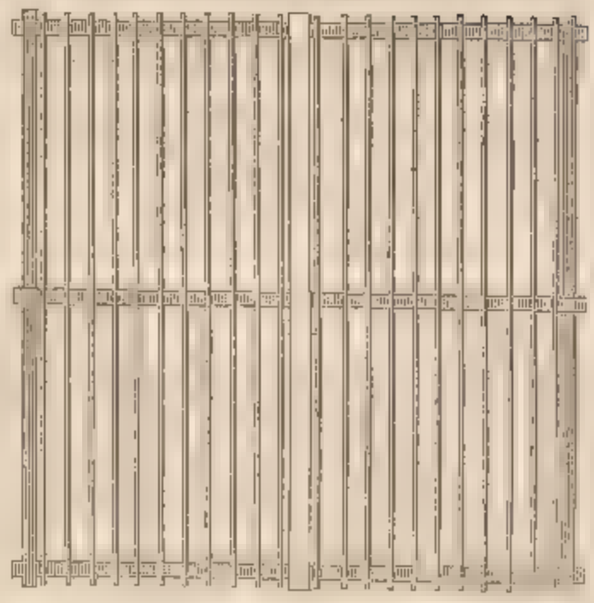
FIG. 1.



If there be only one binding joist, as in fig. 2, on each side of a girder, these bear one-half the weight of the floor, and the girder bears only one-half of that, or one-fourth of the weight of the floor; but the whole of the weight on the girder is on its middle, which is its weakest

place. With girders binding, and bridging joists, the weight of the floor is more equally distributed on the surrounding walls, than with single joists, and the walls appear better tied together. With single joists, however, when the flooring-boards are nailed to them by connecting the side joists with the walls, they will be sufficiently tied together. The above observations are equally applicable to purlins and rafters, in the construction of roofs.

FIG. 2.



SECTION V.

ON FRAMING PARTITIONS.

WHEN wooden partitions are properly trussed they will not only support themselves, but may also be made to support, or greatly relieve, the floors over which they may be placed, and on which they should never be allowed to rest; and, by being properly connected with the walls, they greatly strengthen the whole building. In some situations I have supported the floors of granaries, as in fig. 1. The girders, which were the tie-beams of the trusses, were of small dimensions, with the joists bridging over them. Fig. 2 would answer the same purpose, with less timber and the walls lower. If, however, in either of these cases, posts under the floor, as shown by the dotted lines, would not have been in the way, the girder would have been as effectually supported by them as with the truss, and with both less timber and labour; but, in that case, roofs of

different construction would be necessary. Iron bolts and straps should always be added to connect the truss, when it has much weight to support.

FIG. 1.

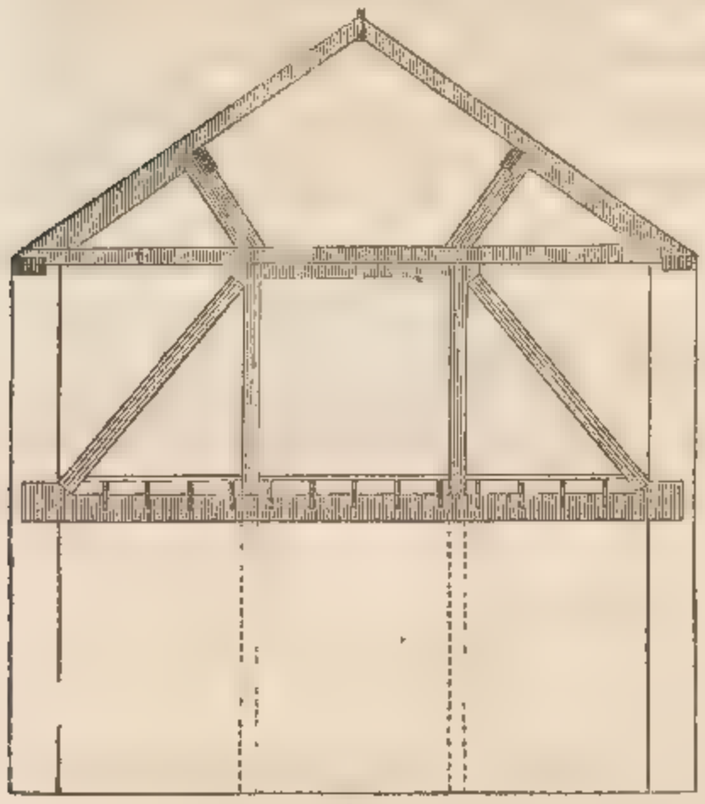
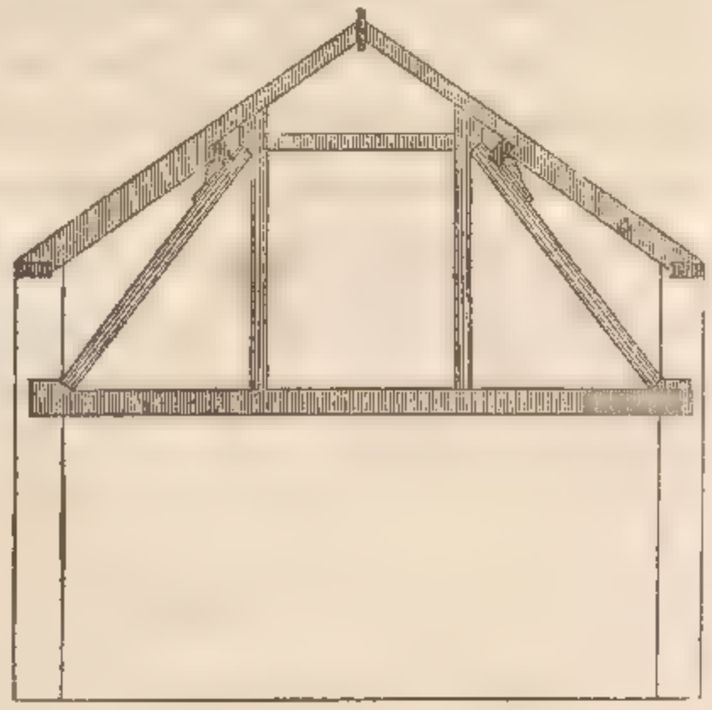


FIG. 2.



If the length of a partition be about twice its height, it may be framed as shown by fig. 3, if there be no door-way.

Fig. 4, represents a trussed partition, with a door in the middle.

FIG. 3.

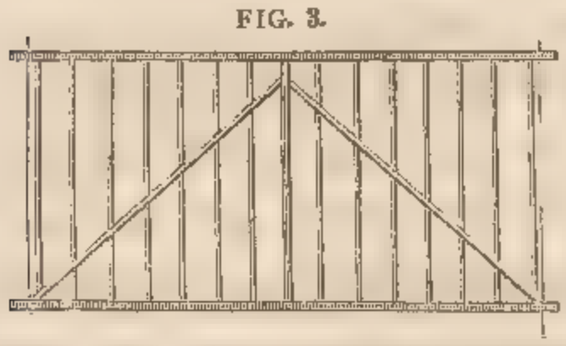


FIG. 4.

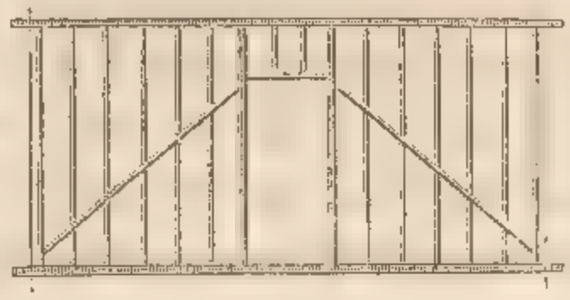
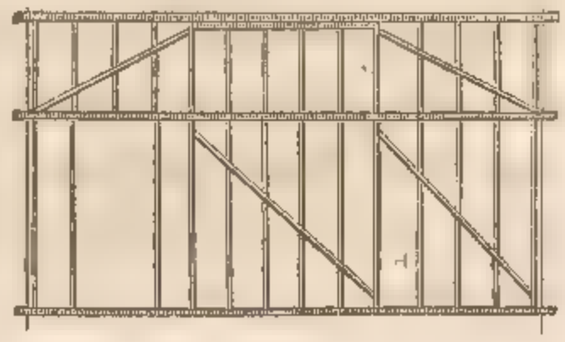


Fig. 5, the lower part for a low room where the door is at one end. If the height of the room will admit of it, the additional truss over the door may be added. In this case, the two trusses should be well connected together by straps, otherwise the plastering will be in danger

FIG. 5.



of being cracked. It is a good suggestion also, to prevent cracks in the plastering of wood partitions, to have the corners of the quartering, braces, &c. where the edges are broad, cut away, that the plastering may have a good key behind the laths; that is, so that the laths may not be nailed close against any broad surface of wood. If the quartering be cut out of small round timber, as larch poles, there will be no corners to cut away. Partitions may generally be made four inches thick.

SECTION VI.

ON THE CONSTRUCTION OF ROOFS.

THE roof of a building is a most essential part. The simple angular roof constituted a principal feature in the temples of the Greeks, and the whole of it was distinctly exhibited. The ends of the roof were terminated with pediments, or ornamented gables; these, being useful parts of the building, were therefore ornamented, and not added merely because of their beauty. In this instance, utility, simplicity, and beauty, are most happily united. The Greeks made their roofs of a low pitch, suited to their climate; but, for our tempestuous climate, roofs of a higher pitch are necessary, the better to shoot off the rains and snows. A high roof is, however, more expensive than one of a lower pitch, because it has a larger surface, and requires timber of greater scantling to make it equally able to resist high winds, and support its greater load. It is, therefore, economical not to make a roof higher than is found, by experience, to be sufficient for the climate and kind of covering.

A roof whose height is one-half the span, will have one-fourth more surface than if it were made of one-fourth the span; and as the timbers of the

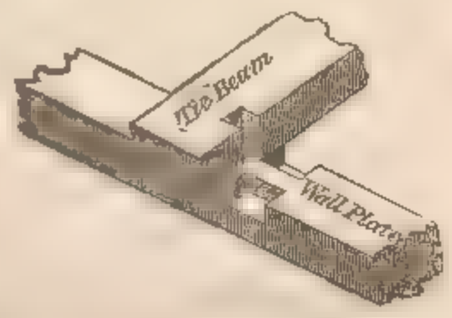
higher pitch must be stronger than the low roof, the difference in the expence will be still greater.

The roof for a narrow building, or cottage, which is not long, may consist of ridge-board rafters and wall-plates only, or with a collar-beam, as shewn by fig. 1. When the buildings are long, tie-beams are requisite; these rest upon and are connected with the wall-plates, and ought not to be more than nine or ten feet apart.

FIG. 1

The connection between the tie-beam and wall-plate is formed by cutting two notches, about an inch deep, and in length the breadth of the tie-beam, in the top of the wall-plate, one on each edge, leaving a space uncut between them. A notch is then made across the underside of the tie-beam, exactly the size of the space left between the notches in the wall-plate. In the annexed figure, the tie-beam is shown laying on its side.

FIG. 2.



If there are rooms in a roof, the tie-beams must be stronger than if they have only to support a ceiling; and, if they have a ceiling to support, they must be a little stronger than where there is none.

Tie-beams should never be much cambered; indeed, if a beam be cambered, a small weight acting upon it has a powerful tendency to push out the walls; but a weight acting on a straight joist, or tie-beam, has as much power or tendency to pull in the walls, by its vibrations, as a comber one has to push it out. However, the increase or diminution of the width can scarcely, in either case, be expressed. If a joist twenty feet long be combered one-tenth of a foot, and, by being loaded, becomes straight, it will be increased in length ·001 parts of a foot, or one twenty-thousandth part of the whole length.

When the buildings are wide, and to be covered at one span, framed trusses, purlins, and pole-plates must be added. These, for farm-buildings, may

be of either of the two forms shown in the margin. If the space in the roof be small, and not required to be used, fig. 3 may be applied; but if it be large, and to be occupied as rooms, fig. 4 will be necessary. The height between the straining-beam and the tie-beam may be increased, by placing the queen-posts nearer to each other. In that case the upper purlins would rest on the back of the principal rafters, as in fig. 2, page 70. Although a low roof looks better than a high one, yet it may be sometimes desirable to make a roof of a higher pitch than what is absolutely necessary for carrying off, and keeping out, rain or snow, in order that head-room may be obtained under the straining-beam. The names of the several parts of these, and the foregoing figures, are the following.—The same letters refer to them all.

FIG. 3.

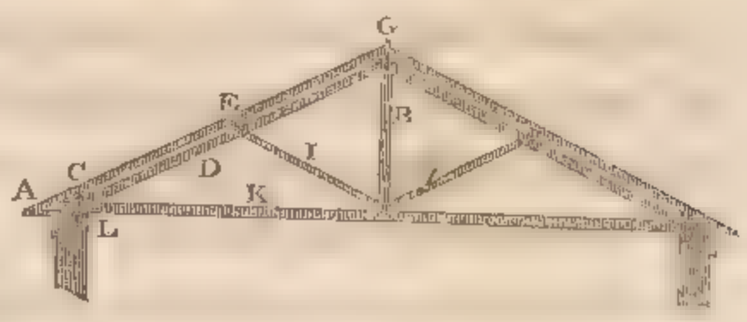
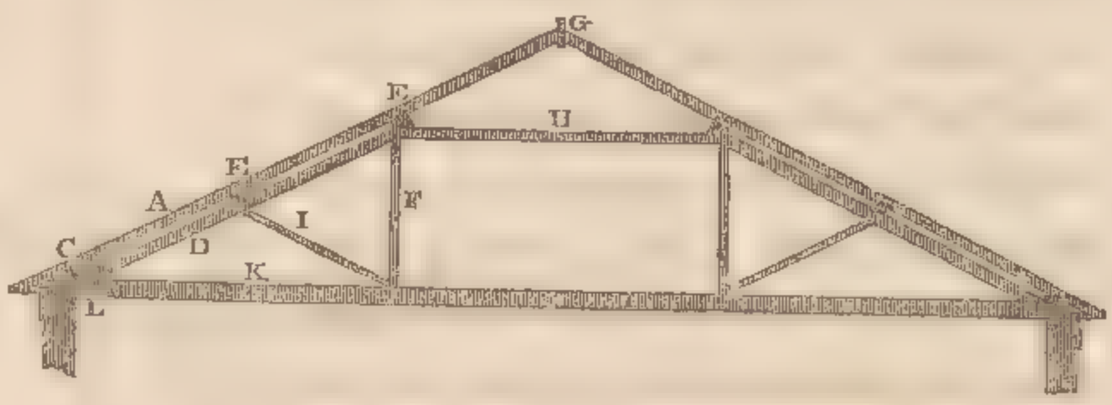


FIG 4.



A	Common Rafter.	G	Ridge-Board.
B	King-Post.	H	Straining-Beam.
C	Pole-Plate.	I	Strutt.
D	Principal Rafter.	K	Tie-Beam.
E	Purline.	L	Wall-Plate.
F	Queen-Post.		

In some situations, where the building is not more than twenty or twenty-five feet long, and purlins are necessary, tie-beams may be dispensed with, if the purlins, *a a*, are strengthened by diagonal braces, *b b*, and collar-pieces, *c c*, as shown by figures 5 and 6, the lower ends of the diagonal braces abutting on the wall-plate, and the collar-pieces extending between the opposite purlins. In barns, the distance between the tie-beams may, in this way, be increased to fourteen feet, which is a convenient width for a bay. The purlins should never be morticed into the principal rafters, but notched upon them, in the same way as the tie-beams to the wall-plates, only, the space between the notches on the back of the rafter should be left as wide as possible. If the purlins have a bearing on each side of the rafter, of about an inch, it will be quite sufficient. In like manner the small or common rafters may be notched on the purlins; and if one rafter be stronger than the rest, it ought not to be laid the flat way to avoid the notching, as is frequently done by country carpenters.

FIG. 5.

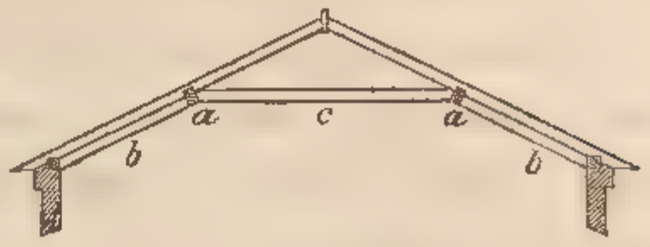
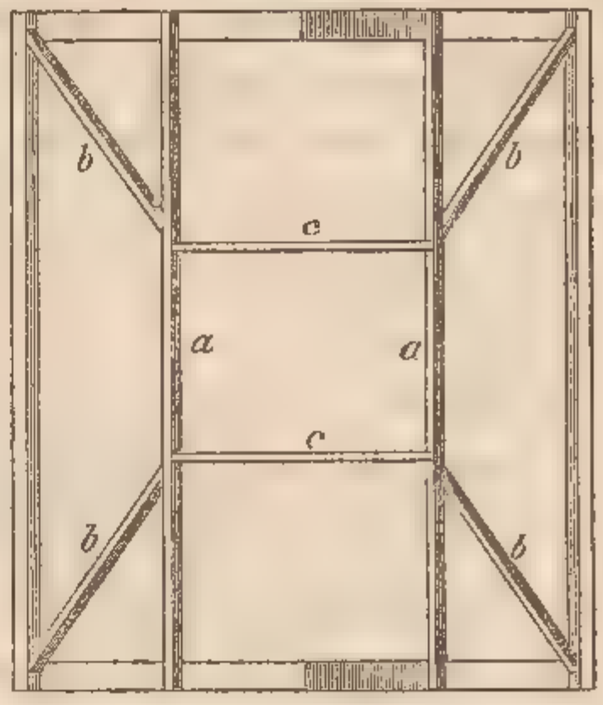


FIG. 6.



In the north of England, where they slate with grey-stone slate, the slates of the eaves are frequently of very large dimensions, and proportionably thick, so that they are very heavy; while the upper ones, next the ridge, are of small dimensions, and comparatively thin and light. Where the slating is to be performed in this way, it is usual to make the lower parts of the rafters larger than the upper parts. The roof shown above the truss, fig. 1, page 70, was for slates of this description.

The bearings of small rafters should be short. Purlins are usually made too slight, and the small rafters too large. Instead of king and queen posts, what are termed suspension pieces may be used, and, indeed, they are considered to be preferable, as the rafters and straining-piece may abut against each other, and the truss is not so affected by the shrinking of the timber, as it is with the broad heads of the king and queen posts. These suspension pieces may be in pairs, each piece half the size of the king or queen posts at their smaller parts; one piece to be put on each side of the truss where the king or queen post would be, and notched a little into the tie-beams and rafters, and then bolted together, and have iron straps to tie them to the tie-beams and rafters. The bolts should pass through the iron straps, and there should be blocks between the suspension pieces at those places. Or, the suspension pieces may be single, and of the same size as the small part of the king or queen posts, and the principal rafters, tie-beam, and straining-beam, connected with them by iron straps and bolts with screws. Instead of making mortices through the tie-beam for the king or queen posts, it is a better plan to have short tenons and shallow mortices, and connect these posts to the tie-beams by means of iron straps.

SECTION VII.

ON THE COVERING OF ROOFS.

ROOFS for plain tiles were formerly made with rafters whose lengths were three-fourths of the span. This was called the true pitch; but, at present, the square pitch is the highest that is used for this kind of covering. A square pitch is in height half the width of the building, the rafters at the ridge

forming a right angle. This pitch is, however, higher than is necessary for plain tiles. Roofs, lower by one-tenth than the square pitch, having their rafters two-thirds of the span, I have found sufficiently high; they may, however, be made still lower than this, to about one-third of the span; but in narrow buildings, if the space in the roof is intended to be occupied, that circumstance ought to be taken into consideration when determining the height of the pitch. The roofs constructed as above stated, were covered in the manner recommended to me by eminent architects of great experience, particularly the late Mr. Carr, of York, who had long practiced it. The mode they have long used is to lay the tiles upon the roof, dry, that is, without bedding them in mortar or any thing else (except under the heads of crooked tiles), and afterwards to plaster them over, on the inside, with coarse hair mortar. The tiles and laths are coated wholly over from rafter to rafter. These architects say, that a roof whose height is only one-third of its span is high enough for a covering of plain tiles, when laid thereon in the manner directed above; but when plain tiles are laid in mortar upon roofs of higher pitch than one-third, the rain water will sometimes insinuate itself between them. The readiest mode to prevent this, is to push out the mortar at the bottoms, or tails, of the tiles, and enlarge the openings there. Whether the rain water is held in the small crevices between the tiles and mortar, in the way of capillary attraction, and is driven in between the edges of adjoining tiles, and is dammed up by the mortar at their tails, until it flows through into the inside of the roof, is not very material. It is sufficient that we know mortar to be frequently injurious when laid between the tiles, and how we can apply it better. Plain tiles are also sometimes bedded with wheat straw.

Roofs for pantiles need not be higher than one-third of the span, in sheltered situations, nor higher than the mean between one-third and one-half, in bleak situations. The following is, perhaps, the best method of covering a roof with pantiles: first, lath the roof wholly over on the upper side of the

rafters; then give it a coat of coarse mortar; and draw over the laths on the inside of the roof, from rafter to rafter, with a little mortar; just sufficient to cover the laths; a long tiling lath is then nailed along each rafter, from the ridge to the eaves, and upon these laths are nailed the pantile-laths, and the pantiles laid upon them, without bedding the tiles in mortar, or even pointing them. If rain finds admittance through a faulty tile, or otherwise, it rarely penetrates the ceiling, but runs freely down it to the eaves; and a faulty pantile may be easily replaced by any farmer's servant. This ceiling under the tiling also prevents the pantiles from being broken or pushed off the roofs of barns, &c. by the forks of workmen employed in filling them with unthrashed grain or fodder.

Roofs for thick grey slates, and for Welsh, Cornish, and other ordinary slates, are frequently made in height three-eighths of the span, the rafters for which are in length five-eighths of the span; but, if those slates be tolerably good, then one-third of the span will be found a sufficient height.

A good method of slating is to lay the slates upon laths, but without mortar, and afterwards to point the joints of the slates on the inside of the roof, and along the sides of the laths and rafters. If the slates are small, they may be wholly covered with mortar. This method prevents snow from being blown into the inside of the roof, which boarding does not; and it also fixes the slates more firmly to the roof. This is the general mode of slating in the north of England, and is found effective in the most exposed and bleak situations. Boarding, however, will be the most proper in close roofs, where, in the event of repairing being required, the pointing could not be made good. When slates are laid on battens, the battens should not be too far apart; every slate, besides resting upon the slate below it, should rest upon two battens. When this precaution has not been attended to, in high winds the slates rattle.

Roofs for Westmoreland slates are, in London, generally made of one-

fourth their span in height, and this height may be sufficient for sheltered situations in the country; but, in bleak situations, it may be adviseable to make them a little higher. In the north of England those slates are much used, and are always laid dry on laths, and pointed on the inside in the manner described in the last paragraph. In Westmorland, Lancashire, &c. they fasten the slates to the laths with lead nails, about $1\frac{3}{4}$ inch long, $\frac{3}{16}$ of an inch thick, and with thin heads, about half an inch broad: these, when put through the holes in the slates, are bent like a hook against the laths by the person who points or plasters, in those districts called tiering, the inside of the roof.

Reeds, heath or ling, chips, and straw, are also used in some places for covering. The pitch for these may be half the width. However, straw for thatch should never be used when other covering can be obtained. If much of it be used for thatching buildings, the farm will be robbed of its manure, and, consequently, its improvement retarded. When straw thatch begins to decay, it must occasion a faint, unpleasant, and perhaps unwholesome smell. Where the water which falls upon the roof is to be collected, thatched buildings of any sort are improper, and, when they get old, they are a great harbour for vermin; indeed, where other materials can be had, thatch of any sort, particularly for dwelling-houses, should be avoided.

TABLE OF SCANTLINGS.

In cutting timber to the greatest advantage it is difficult to make them all to the exact size, some being a little less, others something larger than required; and, as it is difficult to remember fractional numbers, they are therefore avoided, and the nearest whole numbers are given in the following table:

NAMES OF TIMBERS.	Breadth in inches.	LENGTHS OF BEARING, IN FEET,								Distance apart, in feet.
		6	8	10	12	14	16	18	20	
		Depth in inches	Depth in inches	Depth in inches	Depth in inches	Depth in inches	Depth in inches	Depth in inches	Depth in inches	
Girders, required to be morticed ...	10	—	—	—	—	11	12	13	14	10
Binding Joists for Floors.....	6	—	—	9	10	11	12	13	14	8
Ditto Ditto	4	8	9	10	11	12	—	—	—	7
Binding Joists for Ceilings.....	3	5	6	7	8	9	—	—	—	7
Flooring Joists*	2	5	6	7	8	9	10	11	12	1
Ceiling Joists	1¾	3	4	5	—	—	—	—	—	1
Purlins.....	3	7	—	—	—	—	—	—	—	7
Ditto.....	4	—	8	—	—	—	—	—	—	8
Ditto	5	—	—	9	—	—	—	—	—	9
Common Rafters.....	2	4	5	6	7	—	—	—	—	1

Principal Rafters.....	6×4 to 4×4
Tie-Beams	9×6 to 7×4
Straining-Beams	8×6 to 6×4
King-Posts	6×4 to 4×3
Queen-Posts	4×4
Strutts.....	4×3
Pole-Plates	5×5 to 4×4
Wall-Plates.....	4×3

Ridge-Board and Hip-Rafters, 1½ inch thick	
Posts for Partitions.....	4×4 to 4×3
Filling-in Quartering to ditto	4×1¾
Heads, Sills, & Braces to ditto	4×2½ to 4×3
Posts for Cattle Shed.....	6×4
Posts for Cart Shed, with Granary over,	8×5

* Joists for ground floors may be an inch broader than those for other situations, on account of their being more liable to decay; and, for the same reason, sleepers may be thicker than wall-plates.

EXPLANATIONS AND OBSERVATIONS.

ELEVATION AND PLAN OF A DOUBLE COTTAGE FOR LABOURERS.

PLATE I.—No. 1.

BUILDING two cottages together saves much walling, and the occupiers may, on many occasions, afford each other material assistance. Every cottage ought, at least, to have a kitchen, wash-house, and closet, or pantry, with two bed-rooms. A parlour is almost useless. The kitchen, being freed from the business of washing and baking, may always be kept decent for the family to live in, and a decent kitchen is greatly preferable to a disorderly parlour; and a parlour that is not used oftener, perhaps, than two or three times a year, will seldom be kept in order.

In this design, therefore, there is, for each cottager, a kitchen twelve feet square, and a wash-house, pantry, and place for fuel under the stairs, covered with a lean-to or pent-house roof, six feet wide in the clear. The entrance is made immediately into the kitchen; but, in exposed or cold situations, and especially where fuel is dear, a porch should be either taken off the inside of the kitchen, or added to the outside, or a temporary screen or curtain might be used in cold weather. On one side of the kitchen fire there is a cupboard. The wash-house and pantry-floor may be made two steps lower than the kitchen, and the floor over them about two feet lower than the floor over the kitchen; thus there will be room for small beds within the lean-to. The

kitchens are seven feet six inches high, and the bed-rooms over may be made eight feet high by putting the ceiling-joist two feet above the wall-plate. The ceiling-joists may be so many collar-beams to the rafters, which will greatly strengthen the roof. The fire places and flues are in the division-walls. In this position the greatest advantage is derived from the heat, and thus, in small cottages, the chambers would not require, except in sickness, any fires. Two cottages, having the same accommodations, cannot, perhaps, be built at less expense on any other plan.

ELEVATION AND PLAN OF A DOUBLE COTTAGE, WITH OFFICES ADJOINING.

PLATE I.—No. 2.

EVERY cottager, who has a family of children at home, ought, for decency's sake, to have two bed-rooms; and if the children are of both sexes, he ought to have three. For the purpose of thoroughly airing and sweetening the bed-rooms, there ought to be windows to all the rooms.

In this design, each kitchen is twelve feet by thirteen feet, and the back kitchen, or wash-house, which may be on the same level, is six feet by seven feet. The pantry, which may be sunk one step, is partly under the stairs. Each entrance is through a porch, in which is a cupboard to contain the labourers' tools, and beyond the porch is a small room for fuel. At each end of the building are three doors; the first opens into the vault; the second, into the place for ashes or dust; and the third, into the hog-sty, over which is a roost for poultry. The hollow, or cavity, in the wall between the stairs, &c. and pig-sty, is to prevent any soakings or disagreeable smell being perceptible in the

house. The chamber floors being of equal dimensions with the ground floors, each cottager will have two bed-rooms. One room may be made somewhat larger than the other; the larger for the parents, and the smaller for the children. The height of this building is the same as No. 1, the bed-rooms being partly within the roof. A higher elevation would improve the appearance, and render it more wholesome, and will be preferred by those with whom the additional expense is of less consideration than the health and improvement of their cottagers. Lofty bed-rooms are highly conducive to health.

ELEVATION AND PLAN OF A DOUBLE COTTAGE, WITH COW-HOUSE.

PLATE I.—No. 3.

IN this design the kitchens are fourteen feet by twelve feet; the back kitchens are eleven feet by seven feet, and at one end there may be a closet under the stairs for a pantry. There are, also, boilers, and ovens projecting from the back of the house; but, where the cottagers do not make their own bread, or where they eat oat-bread, ovens will not be required. The entrances are through porches in the low buildings, beyond which, as in the last example, is a place for fuel, and at the back of this last is the dairy, with the door from the kitchen. In these lower buildings there is, also, a cow-house for each cottager, in addition to the other conveniences described in No. 2. The situation of some conveniences on a plan, may sometimes appear too conspicuous; but, as at least a garden, however small, is supposed to be attached to every labourer's cottage, the judicious planting of a few evergreen shrubs will give all the privacy required. The doors to the cow-houses are at the back,

and convenient places for collecting manure may be made in the corners against the sides of the hog-sties. Every thing convertible into manure ought to be gathered into these yards. By collecting manures, and preparing them with judgment, ground of an inferior quality may be continued in a profitable and progressive state of improvement, until it has acquired a high degree of fertility. Small tenants should not only be provided with convenient yards for compost dunghills, but should also have pointed out to them, by the proprietors or agents of estates, the various fertilizing substances which lie within their reach; and also be informed which of them will make the most valuable dressings for grounds of the nature of those which they respectively occupy; and such attention to their interests must be gratifying to them. The chamber floor over the kitchens may be divided: small rooms, about six feet wide, with windows above the low buildings, would serve for bed-rooms for daughters; the larger rooms for the parents, and the rooms over the back kitchens for the sons. Should these conveniences not be sufficient, small bed-rooms may be added at each end, over the entrance, dairy, &c.; or, with a little addition in the elevation of the walls above the ceiling of the chambers, tolerable rooms may be formed in the roof. Cottages for manufacturers will require larger rooms, as for looms, &c. If the occupiers of adjoining tenements keep horses, they may unite their teams when a stronger draught than two horses is required for ploughing, or any other work.

If the rooms of a cottage be built too low, or in any other respect upon a bad plan, the inconveniences arising from these circumstances will, in all probability, have to be endured by its successive occupants, as long as the materials of which it is composed will last. If, therefore, the welfare of the inhabitants of such dwellings be considered, it is highly important that any circumstances which would thus entail the want of comfort should be avoided; and it must be gratifying to those who erect durable and efficient cottages, in healthy situations, with gardens attached, to contemplate, on what industry,

what cleanliness, what happiness, and, in short, what a great and lasting improvement in the condition and habits of this class of their fellow-beings, they may, as they have it in their power, by a little attention, so easily, and so beneficially to themselves, effect.

ELEVATIONS AND PLAN OF A SMALL FARM HOUSE AND OUT-OFFICES, FOR A GRAZING FARM ON A MOUNTAINOUS COUNTRY.

[In this and the following designs, the top of the plan is considered to be the North; the bottom, the South; the right, the East; and the left, the West sides.]

PLATE II.—No. 4.

A PARALLELOGRAM is the most simple and least expensive form for the arrangement of farm buildings; if any other form be adopted, more of both materials and labour will be required. The interior of this plan consists of a fold-yard for the cattle, and a court-yard, to keep the cattle, pigs, &c. from the house, which is placed on the east side. On the ground plan of the house are the kitchen, back kitchen, parlour, dairy, and pantry. Both the kitchen and back kitchen overlook the yards, &c. The other window to the kitchen, and also the parlour window, are supposed to overlook the farm. In the back kitchen are shown the situation of the copper or boiler, pump, and sink. The dairy is sunk five steps, for the sake of coolness in summer, and warmth in winter; and the way the benches or shelves may be placed, is shown. The pantry, which is down the same steps leading from the back kitchen to the dairy, is under the stairs to the chamber floor. Under the parlour is the cellar. A part of the cellar may be partitioned off for a store-room for potatoes, &c.

There are, on the first floor, four chambers, and over them two garrets in the roof, lighted from the ends of the house. The chamber over the dairy may be used for the men-servants' bed-room; or, should that not be required, as it will be lofty, it may be used as a store-room. Next the house, on the north, is a stable for four horses. A saddle closet might be conveniently formed in the corner of the stable, at the back of the kitchen fire-place, where the saddles, &c. would always be kept dry. At the other end of the stable, a recess is formed for the corn-bin, near the window. The horses, in passing to and from the stable, through the court-yard, do not mix with or disturb the cattle in the fold-yard. The gate to the court-yard is placed as far as possible from the house; and posts, and rails, or chains, may be placed, as shown by the single line, to keep the horses from, and to protect children at, the door. A tank, for the hogs' wash, may be made in the corner formed by the house and stable. The situation for it is shown by the dotted circle. Arranged along the north side of the yards are the chaff-room next the stable, various offices, open shed, and calf-house. The shed is open to the south, and may be used for cattle, and a part of it for a cart. The space within the roof of either the shed or stable, may be appropriated as repositories for such tools or implements as are only occasionally in use, as hay-rakes, ladders, &c. To a part of the space in the roof of the shed (which may be enclosed), an opening, or door, may be left from the place for fuel. The hen-roost may be in the roof, over the place for ashes, &c. On the west side of the fold-yard are the barn and cow-house; and, as on the farm for which this design is proposed, little corn is grown, the barn may occasionally be used as a store-room for turnips; for this reason there is a door from it to the foddering bay. The cow-house contains standings for sixteen head of cattle, eight on each side of the gangway; a feeding-house for the like number of cattle arranged in a single row, with a foddering bay at their heads, would require one-sixth more area, and one-fourth more wall. Over the cow-house is a straw-room, which may occasionally be filled with unthrashed grain. The

ridges of the roofs of the barn and cow-house are of the same height; but the side walls of the cow-house are about three feet lower than the side walls of the barn. On the wall, between the fold-yard and court-yard, is placed a large water-trough for the cattle in the yard, and for the stable horses. The hog-sty is in the corner next the cow-house, and, in the opposite corner, a court for the store pigs is formed by the post and rail to keep off the cattle; and there the trough for the pigs is placed. The wide door to the barn is made next the fold-yard, but, in some situations, it may be more convenient on the outside; for, when the fold-yard is filled with manure, access with a loaded cart to the barn, that way, may be difficult.

ELEVATION AND PLAN OF A FARM HOUSE AND OUT-BUILDINGS, INTENDED FOR A SMALL ARABLE AND GRAZING FARM.

PLATE III.—No. 5.

THE house, which is here on the west side, is not much larger than in the last design; but there is a porch added to the front. The rooms are differently arranged, and the pantry (over which may be a convenient store-room) and an open shed are added, with other conveniences, and a separate place for tools at the back. The kitchen-court may be enlarged with very little additional expense, if the house is placed so much more to the west, as to make the front wall of the places for coals, &c. in a line with the back wall of the stables; or it might be better if still so much farther back, as to admit of a door-way from the court to the garden; or, where a convenient wood-yard, should one be required, might be formed at the back of the stables. Besides

the kitchen-court, there is a separate court to the stables. The stable contains an additional stall, the chaff-room is enlarged, and a small harness-room is added at the south end. There are also two fold-yards, which are each larger than the one in the last arrangement, and the cattle-sheds are of double the length. As the situation where this fold-yard is placed is considered to be warmer than that for the preceding, fewer cattle will be required to be tied up in houses; and, as there are two yards, the cattle of different strengths and ages may be kept separate from each other. The barn is forty feet long and eighteen feet wide. The cow-house will contain twelve cattle, and there is a loft over it, which may be used for a store of straw, or unthrashed grain. The approach is supposed to be from the east, and the cart-lodge, which is additional, is so placed that it must always be passed as the horses go to the stable; and the granary over it is conveniently near the barn. A roost for hens may be made over the pig-sty adjoining the cart-lodge; and under the steps to the granary, and at the inner part behind the carts, the ploughs and harrows may be placed.

ELEVATION AND PLAN OF A FARM HOUSE AND OUT-BUILDINGS, FOR A LARGER FARM THAN THE LAST, AND DIFFERENTLY ARRANGED.

PLATE IV.—No 6.

IN this design, besides containing the conveniences of the foregoing plans, which are all enlarged, there are an additional and separate house for brewing, baking, and washing; a three-stall stable, a saddle-room, two additional houses for cattle; and also a thrashing machine, and the requisite accompaniments. The arrangement is also different to the last. The chimneys are in the middle

wall of the house; cupboards may be formed in the recesses on each side of the parlour fire, behind which a cavity is left in the wall, to prevent its communicating heat to the dairy. This precaution may not always be necessary; for, when the heat would be injurious to the dairy, a fire would not generally be required in the parlour; but, as the cavity formed in a new erection would cost nothing, it would be better to make it, as many circumstances might arise to render a fire there, even in the summer, necessary. The bed-room for the men, in this plan, is intended to be over the back kitchen, to which there is a separate staircase, or steps; and the house is raised one story higher, instead of having rooms in the roof. Should a bacon-room be required, it may be made over the coal-house, and entered from the steps to the men's bed-room, and it ought to have a thorough draft of air through it, and may be fitted up with racks, allowing a space for a current of air between the flitches. The brew-house may be used for brining wheat; an additional small boiler may be placed in it, for boiling pigs' food, &c.; and there should be either another window, or an opening in the roof, to carry off the steam. The observations respecting altering the position of the house, the enlarging of the kitchen-court, the formation of a wood-yard, &c. in the preceding design, are equally applicable here. The saddle-room in this plan being adjoining the brewhouse, the heat arising from the oven, there, will render a stove unnecessary, as the room, by that means, will always be kept dry. The rick-yard is supposed to be surrounding the barn. The straw-room is conveniently placed for the cattle-sheds, and the granary is intended to be over it. A door may be sometimes convenient at the end of the stable, or at the back of the cattle-sheds, for the horses to go from the stable to the thrashing-machine. If wide or folding doors be at the back of the cattle-sheds, they may, in some situations, be found very convenient for carting out the manure, &c. The privy, for the men, is placed in the corner of the horse-track. The tanks, for the hogs' food, may be placed within the entrance gate to the stable-court, where they will be conveniently near the

house, and to the trough in the hogs'-court, in the corner of the fold-yard. The situation of the pig-sties admits of their being cleaned out with facility; as the doors open into the fold-yards, the dung from them will not require to be wheeled out. The entrance to the covered part of the sty is made at the south corner; in this way the sty is more comfortable for the pigs, than if the entrance was made in the middle. Hen-roosts may be in the roofs, over the pig-sties. In this plan all projections in the fold-yards are avoided.

ELEVATION AND PLAN OF A FARM HOUSE AND OUT-BUILDINGS, STILL LARGER THAN THE PRECEDING.

PLATE V.—No. 7.

ALTHOUGH somewhat more extended in magnitude than No. 6, yet the principal difference between this and the last design, consists in the great variation of the arrangements. The dwelling-house, with the attached offices, are all placed southward of the fold-yard; the front and back door to the house opens into a passage, or hall; the dairy, with the cheese-room, or store-room, over it, is not under the principal roof, but in an attached wing; and a separate scullery, for making cheese and cleaning the dairy utensils, adjoins the common kitchen. In consequence of the alteration in the situation of the dairy, there is a room on the ground floor, in the principal part of the house, which may be appropriated for an office, or business-room, with a good-sized closet adjoining. The cheese-press-house adjoins the dairy; but this may occasionally be used for other purposes. Some farmers place their cheese-presses in an open yard. The window to the pantry, in some situations, may be better placed on the north

side. The stairs to the men's bed-room, which may be over the living-room, is from the dairy-scullery. If the situation will admit of it, the distance between the house and the fold-yard may be made greater, and this may be effected with very little additional expense. If one or both of the entrance-gates to the court-yard are close boarded, the warmth of the yard will be greatly increased; on the contrary, if with open gates only, in most situations a strong current of air would generally be found to pass through the court-yard, which, in cold weather, being so exposed, would be found very injurious in many respects. This is one great objection to having a public road between the house and the fold-yard; for the back of the house, in that case, cannot be well sheltered, and, at the same time, have a good view of the fold-yard. The approach to this homestead is supposed to be from the west, and the cart-lodge with granary over it, the stables, &c., in that respect, are conveniently arranged. To these conveniences, on this plan, a loose box is added; a small fire-place is shown in the harness-room; the large stable will contain six horses; and the cattle-sheds are more extended, and a division in one or both of these may be enclosed for a place for sick cattle, and for a bull, if required. The floor over the foddering-bay, and the bay for sick cattle, adjoining the barn, may be occasionally used for unthrashed grain. The other bay for cattle in this house, and the other buildings towards the south, are all open to the roof.

PLAN OF A FARM HOUSE AND OUT-BUILDINGS, FURTHER INCREASED IN DIMENSIONS, AND VARYING IN ARRANGEMENT, WITH AN ISOMETRICAL PERSPECTIVE VIEW.

PLATES VI. AND VII.—No. 8.

THE general arrangement of this plan is something similar to No. 6, but of larger dimensions, principally occasioned by the addition of a third fold-yard and cattle-shed. Over the centre shed is the granary: this shed is also so much wider than the others as to allow of a gangway, or fodderem, to form a communication between the straw-room and the other cattle-sheds. The steps to the granary are shown outside, at the back; but to enter by a step-ladder within, in the gangway, would, perhaps, be a preferable mode. In that situation the steps might be placed so as to be seen from the house, and no person could go up or down without being observed. The top of the steps might be hinged to the floor, and, when not in use, the other end might be hooked up to the joists, and there, if required, secured by a lock.

Isometrical Perspective is a term given recently by Professor Farish, of Cambridge, to a projection made in rays parallel to the diagonal of a cube upon a plane perpendicular thereto. This is a comprehensive and useful method of exhibiting the several parts of a homestead, and any person moderately acquainted with drawing, if they will make the attempt, will find it extremely easy to perform, nothing more being required than to divide a circle into six equal parts, which may be done with the radius, and draw the hexagon and three radii, one radius to every other angle, to represent a cube, as is shown by the diagram, plate VII. All the vertical or plumb lines, in any design, are then to be drawn parallel to *a b*; all

those in the direction, say north and south, parallel to *a c*; and all those at right angles, or perpendicular to the last, or in the direction east and west, parallel to *a d*; and the several heights, lengths, and breadths, being taken from a scale of equal parts, and set off, and lines drawn in these three directions, the projection is produced. The position of any point, or the direction of any other line, may be found by finding where the first would fall upon any plane parallel to either of the three sides of the cube, and where the latter, if produced, would cross any lines in the three directions.

PLAN OF A FARM HOUSE AND OUT-BUILDINGS, OF THE LARGEST DIMENSIONS, WITH AN ISOMETRICAL PERSPECTIVE VIEW.

PLATES VIII. AND IX.—No. 9.

ON the east side of this design is supposed to be a road, from which there is an entrance to a garden in the front of the house; and from this road a gate is also supposed to open into the rick-yard, which is at the back of the cattle-shed, and north end of the barn; through this, to the houses on the west side, pass the carts with turnips and other provender for the cattle.

In one of the foddering bays a cistern for water, for washing turnips, is shown. This is particularly described in page 40 (Chap. IV. Art. 4). The window to the business-room, overlooking the yard, may be made to open to the floor, to admit persons occasionally; or, if many labourers are to be paid, a shed, or lean-to roof, may be placed in the angle on the outside, under which they may stand when they receive their wages through the window. Another window to the living-room, in the corner at the north

side of the fire, would give a greater command of the entrance, &c. The cart-lodge in this and the other designs may occasionally be used as a work-shop for repairing carts, &c.

If the house and fold-yard buildings were further separated, a gateway might be made between the hog-sties and the calf-house, in the west wing. This would also afford room for a work-shop or forge on the east side, near the entrance, where such a convenience could be very properly placed.

This and all the preceding plans are drawn to the same scale; thus, by mere inspection, a general comparison of their respective magnitudes may be made. The several parts of each design must be considered of as small dimensions as are deemed essentially requisite; if smaller they will certainly not be so well; but, if expense be not an object, they may undoubtedly be improved if the dimensions are increased; however, in an economical point of view, it is better to have a house too small for a day than too large for a year; and that it is as necessary to consider future repairs, as well as the original cost.

THE IMPROVED FIELD-GATE.

PLATE X.

THE various methods in use for bracing common gates for fields, prove that not one of them is greatly superior to the rest; for, if it were, that method would have been generally adopted. Most gates are loaded with superfluous timber in some of their parts, and are constructed upon such bad principles that they are frequently broken by their own weight, aided by

the concussion of the head against the falling post, and this long before any part of the wood has begun to decay. Being impressed with the idea, that if common gates could be constructed with less timber, and upon better principles, the saving of timber only would be of national importance, for we have some millions of gates to uphold in Britain, and their numbers are annually increasing; the result of my labour has been the accompanying design. Gates made according to it possess great strength, are very light, and of easy and simple construction, requiring less labour than most common gates. Although uniformity of appearance be not essential in a common gate, yet it is worth having when it can be obtained, as in this gate, without additional expense. My gate may be made with short pieces, and consequently it may be formed of less valuable oak or ash timber than is required for those of the commonest construction; and it is also found, proportionally, more durable.

More than fifty years ago I designed plans for ornamental gates, with semi-oval and semi-circular braces, and had them executed. The plans were sent to my friends in various distant parts of this country, as also to Ireland; and I have the pleasure to observe that they are become almost the only ornamental wood gate in many parts of England. The plans of them I never published, although they were prepared for engraving thirty-eight years ago; and I should be as indifferent about my present design of a common field-gate, if I did not conceive that its publication would materially benefit the country; the introduction of this form being, I conceive, of some national importance.

This gate, as shown in the engraving, with the wicket to open on the one hand, and with a fixed one, to correspond, on the other, has been used for the approach to a country residence.

ON THE CONSTRUCTION OF THE GATE.

The following dimensions are calculated for the head and heel to be of oak, and bars and braces to be foreign fir. If inferior materials are

used, they may be made a little thicker, but the breadth should remain the same.

	A	B
The heel of the gate to be about.....	$3\frac{1}{2}$ by	$2\frac{3}{4}$ inches
The head of ditto.....	$2\frac{1}{2}$ by	$2\frac{3}{4}$ inches
The top rail, or bar, vertical piece	$3\frac{1}{2}$ by	$1\frac{1}{4}$ inches
Ditto .... horizontal piece	$1\frac{1}{4}$ by	6 inches
The bottom bar.....	$3\frac{1}{2}$ by	$1\frac{1}{4}$ inches
The other four bars, and the four braces ...	$2\frac{1}{2}$ by	$1\frac{1}{4}$ inches

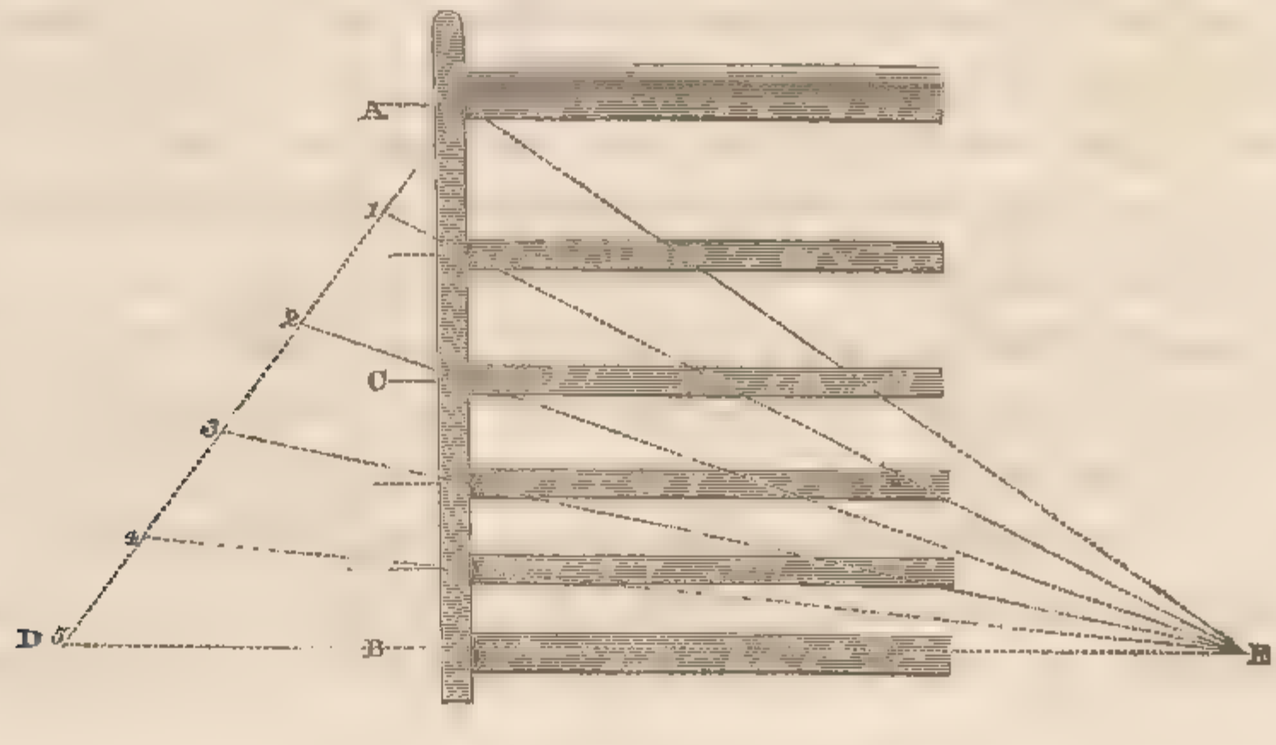
The dimensions in the column under A are taken on the face of the gate; those in the column under B are taken in the direction of its thickness.

Narrow and thick bars, when braced, as in this design, are stronger than broad and thin ones, containing the same quantity of timber, and they also oppose a less surface to the wind. The two points in the heel of the gate, to which the thimbles are fastened, may be considered as firm or fixed points. From these points, viz. 1 and 2, two braces proceed to 4 and 3 in the middle of the bottom and top bars, and being there secured, these become fixed points, and from these two points, viz. 4 and 3, two braces proceed to 5 and 6, fixing those points. The gate is thus doubly braced, viz. from the top of the heel to the top of the head, by means of the braces 1, 4, and 4, 5; and from the bottom of the heel to the bottom of the head, by means of the braces 2, 3, and 3, 6. On each side of the gate are two braces, and those parallel to each other. The brace proceeding from the bottom of the heel of the gate, and that which is parallel to it, as also the bottom bar, are all strained in the way of compression; and the brace proceeding from the top of the heel, and the other brace which is parallel to it, and also the top bar, are all strained in the way of extension. The strains in this gate being none of them transverse, but all longitudinal, it would support a vast weight at its head, without having its form altered. All the braces serve the double purpose of keeping the gate in its due form, and of shortening the bearings of the bars, and strengthening them. Few gates have less timber

in their braces, and, perhaps, in no other way can a gate be so firmly braced with so small a quantity of timber. At 3, 4, 7, and 8, two braces and a bar of the gate are firmly screwed together, by means of iron pins and screw-nuts. At the other points, where only one brace crosses a bar, common gate nails are used. To resist the pressure of heavy cattle, a bar, or board, about six inches broad and one and a quarter inches thick, should be laid with its broad side upon the top bar (see section at C), and fixed thereto by means of the ends of the braces in the middle, and by the head and heel of the gate at the two ends of it. This board will, in this position, resist about the same horizontal pressure as a thick top bar three and a half inches square, although it contains little more than half the timber.

It is necessary that the lower bars of a field or fold gate should be sufficiently close to prevent pigs, lambs, &c. from getting through; but the distances between the upper bars should be greater, that it may be constructed without either unnecessary wood or weight. In order, therefore, to arrange the bars so that the increase of their distances may be uniform, the following rules may be serviceable:

The height between the bottom bar and the top bar being given, the position of the other four bars, or for any other number of bars, may be found; thus, suppose A B the given height, to which the width of an intermediate bar



is added—one half on the top bar, and the other half on the bottom bar. One bar must always be exactly in the middle between these two, as at C, to which the braces, at their crossing, are to be bolted. In this design another bar is required between A and C, and two bars between C and B; that is, the whole distance, A B, is to be divided into five parts, in a regular progression to each other. Draw any line, A D, and from A, set off, of any length, five equal divisions; from the second division draw a line through C, in the direction E, and from the fifth division draw a line through B, also in the direction E, where the two lines will cross; then, from the divisions 1, 3, and 4, draw other lines to E, the point last found, and where these lines cross the line A B, will be the positions of the centres of the breadths of the other bars. From the centre of each bar, thus found, mark off half the length of each mortice, and whether the rails be of the same width as the mortices, or tenanted with an equal shoulder on their upper and lower edges, they will all be in a regular progression.

Or, in numbers, if the distance A B be divided into 110 equal parts;

The First distance from B will be	16 of those parts			
Second	18	55		
Third	21			110
Fourth	25	55		
Fifth	30			

The progressive differences between the distances being 2, 3, 4, and 5; the three first being equal to the two last, and the whole equal to one hundred and ten.

But if adjusted in the proportion of the following numbers, the whole height, A B, being divided into thirty equal parts, the bars at the bottom of the gate will be a little closer.

The First distance	4		
Second	5	15	
Third	6		30
Fourth	7	15	
Fifth	8		

These numbers have one as a common difference.

If the rails have shoulders, and are pinned so as to draw them close to the head and heel, they will be better than without shoulders. The pins should not be exactly in the middle of the breadth of the head and heel, but nearer the inner edge, that the piece of wood between the pin-hole and the end of the rails may not be so liable to split out.

ON THE HANGING OF GATES.

When gates are hung to open one way only, their heels and heads generally rest against the hanging and falling post, and are about six inches longer than the opening; but when they are hung according to this design, gates may be made one foot shorter, or six inches less than the opening; and, consequently, they are lighter, stronger, and less expensive. The heel may be three and a half inches from the hanging-post, and the head two and a half inches from the falling-post.

When the two hooks in the hanging-post are placed in the same perpendicular line, a gate, like a door, will rest in any position to which it may be opened; but in order that a gate may shut itself when thrown open, the hooks must not be in the same perpendicular line, and the farther they are out of it, the greater will be the force with which the gate will close. The following is a method of fixing the hooks and eyes, or thimbles, to answer this purpose.

Supposing the hanging-post to be set perpendicular, and that one side or face of the gate is intended to be in a line with one side of the posts, as shown in the engraving, the centre of the upper hook may be two and a half inches from the inside, and one inch from the face of the post. The centre of the eye, or thimble, for the upper hook, may be one inch from the heel, and one inch from the face of the gate. The centre of the lower hook may be an inch and a half from the inside, and half an inch from the face of the post. The eye for the lower hook may be two inches from the heel, and half an inch from the face of the gate. The best way of fixing the hooks to wooden posts, is to have

shoulders to keep them at the proper distance, and a screw and nut on the end which is to go into the post, to which they should be tightly screwed. The eyes should have straps to go on each side of the heel, and along the bottom and top rails of the gate. The straps for the bottom eye may be about six inches long, with two holes for bolts; one of the bolts to go through the middle of the heel, and the other through the bottom rail and brace. The straps to the top eye may be nine inches long, with three holes for bolts. Blocks being fitted in between the straps and the bars, the nuts are then screwed on the bolts. Eyes of this description, which answered very well, have been made of cast iron; the pins and screws of the hooks were wrought iron, the other part cast.

The position of a plane passing through the centre of each hook is shown in the engraving, by the dotted line A B, on the plan. If the gate was opened to B, it would be at its highest elevation, and would have a tendency to fall either way, until it arives at A, when the head will be at its lowest descent. If the gate be shut, the spur and catch prevent the head from falling to its lowest position; but the tendency it has to fall to A, is designed to assist in keeping the gate closed.

This description for the gate, and the principal part of the foregoing observations, were communicated to the Society of Arts, in 1803; since which time vast numbers of gates have been made after this plan. In some places they are a little defective, there being no bar exactly at the crossing of the braces; but from the additional instruction now given, to find the position of the bars, they may, with a little attention, be always constructed right, if the height be varied, which in some cases may be desirable.

The iron-work of the gate ought at least to be painted. If the whole of the gate be painted, the appearance is greatly improved; and if, when painted, the wood be quite dry, it will be likely to last longer. Gates, in close situations under trees, although painted, will sooner decay than gates not painted, in

open and more exposed grounds; and this circumstance has, perhaps, induced some persons to conclude that the paint, instead of the situation under trees, was injurious to the gates.

ON AN IMPROVED STAND, OR BASE, FOR CORN-RICKS.

MORE than half our corn-ricks are placed on the ground, with only a few small branches of trees, and a little straw, under them. The moisture of the ground is sure to ascend through these to the corn at and near the bottom of the rick, rendering it damp and musty, and, consequently, less nourishing and less valuable. Wheat-ricks are generally placed upon stands, to prevent rats and mice from getting into them. These stands are commonly made with stone pillars and caps, and strong bearers of wood, which are expensive in the first instance, and the bearers will occasionally want to be renewed. On plate X. is given a perspective view and plan of a circular rick-stand for corn, twelve feet eight inches in diameter. It consists of two concentric circular walls, the outer wall covered with flag stones, which project four inches over it, to prevent rats and mice from getting up into the rick. These walls are built at small expense where stones are plentiful. Those built by my nephews, Charles and William Waistell, of Cleasby and Thorp Grange, have their outside wall twenty inches thick, and the inside wall eighteen inches thick, and the distance between the two walls twenty inches. Across this opening are laid hedge stakes, which are sufficiently long to support the rick so that no large timber, or other strong and expensive bearers of any kind, are wanted. The outer wall is twenty inches high, to the top of the projecting flags. At about half its height, four grates of cast iron, about six inches square,

and half an inch thick, are placed in openings left through the external walls, at equal distances from each other, to admit air. The bars of the grates are a quarter of an inch broad, and a quarter of an inch distant from each other, which is sufficiently close to prevent the entrance of mice.

Stands thus constructed are considered, by those who have tried them, to be less expensive and more effective than on any other plan that has been yet invented. The air that passes through these four grates, and through the openings in the internal walls, will circulate freely under the rick; and, if a chimney be carried up the middle of the rick, to its top, the current of air that will pass up through it, will carry off the heat and moisture, which might otherwise injure, and even spoil, such corn as was rather too moist when carried.

During the harvest of 1819 the sun was very hot, which soon dried the outside of the sheaves of corn, and induced many farmers to stack theirs before it was sufficiently dried internally to prevent its heating; for it required, in that year, a longer time than it usually does in dry weather, to accomplish this, owing to the stillness of the air, a brisk dry air being as essential as a hot sun to dry the corn quickly when bound up in sheaves. The consequence of this imprudent haste was, that many farmers had several corn-ricks so much heated as to render it necessary, to prevent the worst consequences, to take them down and carry them out into the field, in order to have them sufficiently dried; thus occasioning great expense and waste, besides diminishing the nutritious quality of the grain that remained, and destroying its vegetative powers.

It is well known that wheat produces the most flour and the sweetest bread, when thrashed out before it has been stacked; and as all corn is more or less injured in both these respects, accordingly as it is more or less heated in the rick, it would be highly desirable totally to prevent its heating, or becoming musty, in the ricks. In wet harvests it is sometimes impossible to get corn

sufficiently dried; and we see that even in hot and dry harvests, such as that of 1819, a great deal of corn is sometimes spoiled in the ricks; we should, therefore, be extremely cautious to have corn well dried in the field, the ricks made of a moderate size, and raised off the ground, to admit the air to circulate under them, with chimneys to allow a current of air to pass upwards through them, to carry off the hot and musty air from the centre of the rick, which, without such a chimney, has its tendency to heat four-fold greater than one with a chimney. Chimneys being easily made, and so beneficial, it were to be wished that they were in general use.

Not only corn, but hay also, is much injured when placed on the ground, being idly considered as unavoidable, and yet a little inquiry into this matter will convince any one that the annual waste of hay, by this means, must be immense, and may easily be avoided. Fifty years ago, observing that there was frequently a deal of hay at the bottoms of ricks, rendered mouldy and musty, and unfit for any animal to eat, even when the ricks had been built upon large quantities of logs of wood covered with straw, I, therefore, determined to try the effect of raising their bottoms from the ground, so that the air might circulate under them. I made the bottoms five yards wide, and fifteen yards long; for each, three walls, about a foot high, were built parallel to each other, the whole length of the rick; across these walls was laid timber from old buildings, that was useless for any other purpose than the fire. The cost of this rick-stand was not more than the hay saved the first year. In each rick two chimneys were built; these were formed with a mould made by connecting three hoops, 12, 14, and 16 inches in diameter, at equal distances from each other, by means of laths six feet long, and nailed to the hoops at about two inches apart. One of these moulds was placed upon its smallest end, at the bottom of the rick, where a chimney was required, and as the rick was built it was drawn up, and at last taken out at the top of the roof. During a period of fourteen years I built all the ricks in this way, and I never had any

hay over-heated, although I have got together three hundred waggon loads in one year.

After we have manured our meadows richly, mowed the grass, and made the hay and carried it home, we ought certainly to preserve with care what has been obtained at so much expense.

The situation of the rick-yards, whether for hay or corn, should be immediately at the back of the farm-buildings; those for corn, at the back of the barn.

REMARKS ON THE PLAN OF CATERHAM FARM-YARD, AS IT WAS.

[This and the following Plan are drawn to a smaller scale than the preceding Designs for Farm-buildings, in order to avoid a folding Plate.]

PLATE XI.

THE buildings represented by this plan were, perhaps, built at six or seven different periods; and as each additional portion was erected, it is quite evident, no regard whatever was paid to the situation of the previously existing conveniences. The irregular way they were scattered about, show that no reason can be assigned for (as Mr. Arthur Young has observed with respect to farm-buildings generally) "three-fourths of their arrangement;" and almost every building would have been better placed in some other situation than that in which it was found. This farm-yard has not been selected as an example of the worst description; indeed, few ancient farm-yards, comparatively speaking, are better, while many are worse arranged. The tool-house, hen-house, and the three stables on the west side, which were thatched, were certainly placed too

near the house. The cart-shed was partly appropriated for pig-sties; its front being open to the north, rendered it quite unfit for a winter cattle-shed. It would be difficult, if not impossible, to conceive the reason for placing what was called the coach-house, in the situation where it was found. The entrance to the fold-yard being on the north-east, in going to and from these buildings, which, in that respect, were very inconveniently placed, the worst part of the yard had always to be crossed. To northern farmers, it will appear strange to see so many as four large barge barns, with so very few of other necessary conveniences. The projecting chaff-house formed very dangerous corners, and prevented a view of one barn-door from the back of the dwelling-house. The only shed appropriated for cattle, was the one at the end of the north barn; this was twenty-three feet deep, and only eleven feet wide at the entrance. The weak cattle, if at the further end, must have been in danger of being injured by the stronger, there being no way for their escape. At the corner of the church-yard, adjoining the pond, was the place for water; but the cattle usually drank the water, which was as black as treacle, that was allowed to stand in the middle of the fold-yard. The place for water at the pond, and the various external and internal angles, were all dangerous for cattle. As there was only one yard, the weak and strong cattle could not be kept separate, and as the doors of the buildings were next the yard, both cattle and pigs must frequently have got into them, particularly into the stables, when the doors were open. It is also probable, that they must have often got out of the yard through the entrance gate, as the ingress and egress that way must have been very frequent. The various open spaces between the buildings on the west, the north, and the east sides, exposed the yard to the most inclement winds, and not a corner could afford shelter to the cattle. For some motive, certainly not easy to be discovered, the waggon-hovel or shed, was placed in a field at some distance from any of the farm buildings, or any road, and there was the breadth of a field between the rick-yard and the barn nearest to it.

REMARKS ON THE PLAN OF CATERHAM FARM YARD, AS IT HAS BEEN IMPROVED.

PLATE XII.

THE situation of this farm-yard is such that it was necessary to retain the entrance at the north-east corner, but trees have been planted in a field, opposite the end of the bailiff's cottage, to break the east wind. As economy was to be considered, those of the previously existing buildings that were tolerable, either as to condition or situation, were to stand, and the old wood materials of the buildings pulled down, were to be used to the best advantage. The dark-tinted parts of the plan, shew those buildings that were only repaired; the middle tint, shews those that were principally formed out of the old materials from the buildings pulled down; and the light-tinted parts, are those conveniences formed principally of new materials. As the existing barns determined the west side, and the pond and church-yard the east side, it became necessary, in dividing the intermediate space, to have one fold-yard to the north, and the other southward of it; therefore, the sheds to both fold-yards could not have a south aspect. The cattle shed to the north yard is made as long as possible, so as to leave a sufficient entrance into the stable-court. The oblique position of the wall on the east side of the fold-yards, is to allow a cart or waggon coming to the house, &c. sufficient room to turn at the south end of the stable-court. The waggon-shed, which was brought from the

field alluded to in the last description, is conveniently situated for putting in the waggons, and the men can have no apology for neglecting to do so. This last, and indeed all the buildings formed principally out of old materials, as well as the barns, are thatched: the granary is, therefore, a detached building, standing upon pillars, to keep it free from vermin. Some of the sheds are thatched with the chips made by the woodmen, in working-up the hazel of the country for coopers and others in the London market. A roof thatched with these chips, is not more expensive than the best wheat-straw, and appears from these buildings, which have been done about six years, to answer the purpose better. Cattle may be tied up, if required, in the shed to the south fold-yard. Although the fold-yards are of very considerable magnitude, yet, from the great extent of the barns, there was not space in the principal range of buildings for the feeding sheds; these were, therefore, placed at the back of the west side, with a small yard for dung. If a thrashing machine had been used, the north barn extended to the west side, would have been sufficient; and the barn-room between that and the cow-house might have been converted into feeding-sheds and store-rooms, for which the space is just adapted. The feeding sheds will contain twenty cattle; they are shewn open in front, but in consequence of their aspect, and the elevated situation, the openings are enclosed with hurdles, which, as well as the gate to the yard, are filled with furze or whins during severe weather. The feeding-sheds and troughs to the fold-yards and stable-court, are supplied with water from the pond by means of pipes and a pump. The cow-house will hold six cows, and, by the door on the west side, they can be turned out that way to the meadow, thus avoiding passing through, or mixing with, the cattle in the fold-yards. The overflowings of the fold-yards are conducted into a reservoir in the meadow, and the accumulating contents is, from time to time, emptied upon it. The rick-yard is now placed immediately at the back of the north barn, &c., and the way to it

is from a lane running north from the end of the bailiff's cottage. There is also a door-way, at the back of the north cattle-shed, to the rick-yard. It may be necessary to notice that the area of the buildings, in the old plan, was nearly equal to the present; the comparison of their respective utility must, therefore, be made between the arrangements of the buildings, and their appropriation.

INDEX.

THE END.

ERRATA.

Page 36, line 9, after *aspect* instead of a *comma* should be a *colon*.

—— ib. — 10, after *straw room* instead of a *colon* should be a *comma*.

——104, — 8, the word *barge* should be omitted.

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LABOURERS COTTAGES.

N° I

Elevation

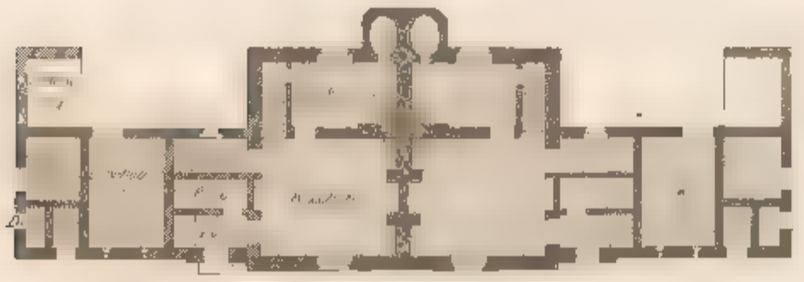
Ground Plan.

N° II

Front

Ground Plan

N° III.



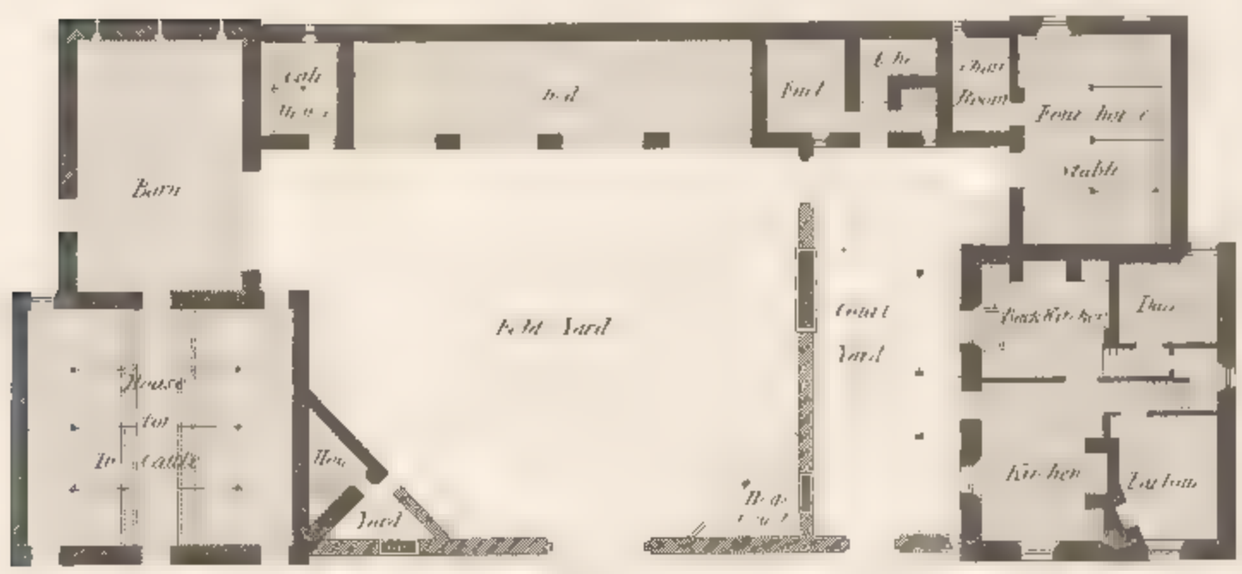
Ground Plan

FARM HOUSE AND OUT-BUILDINGS.

Nº IV.

North Elevation

South Elevation

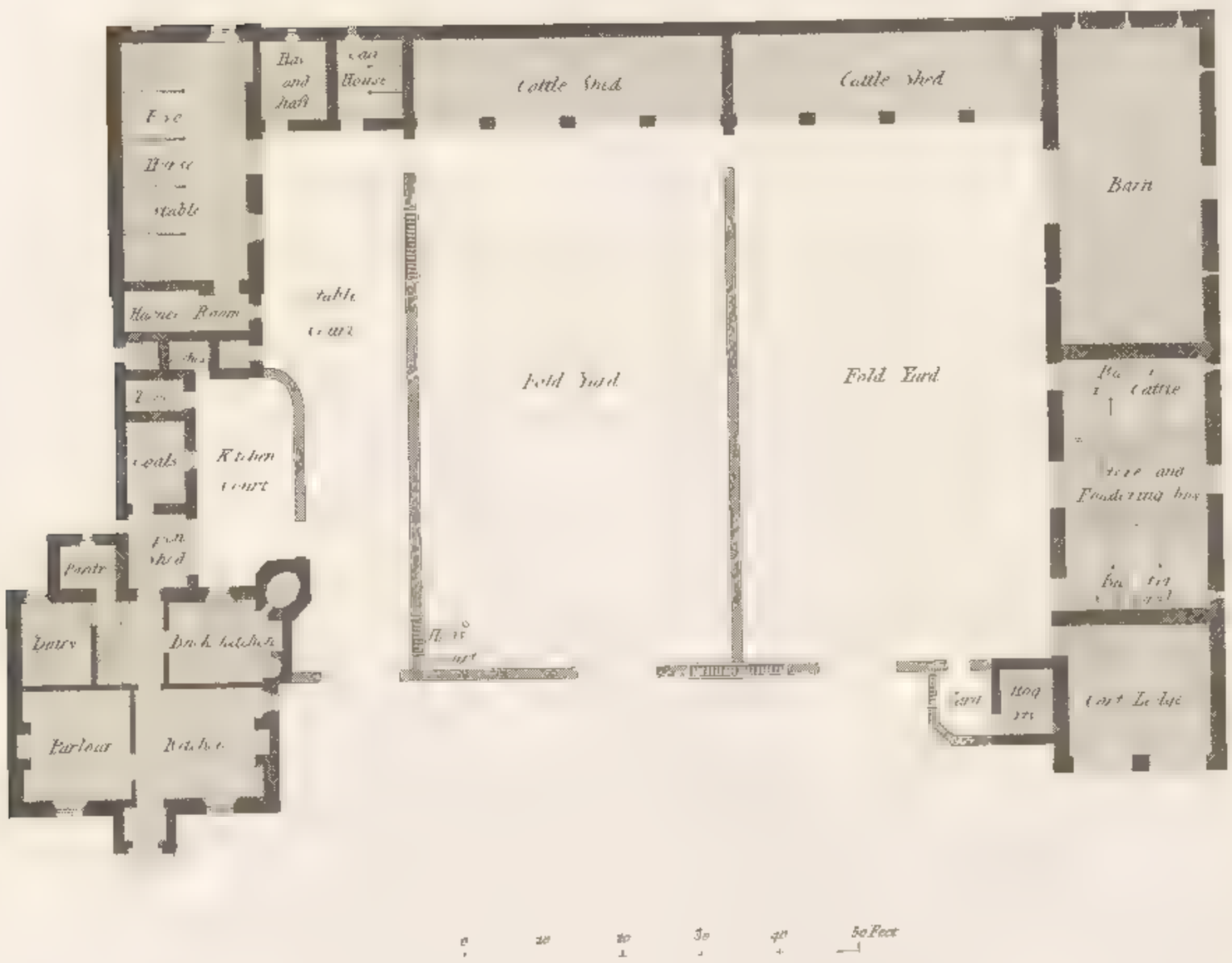


Ground Plan

FARM HOUSE AND OUT-BUILDINGS.

Nº V.

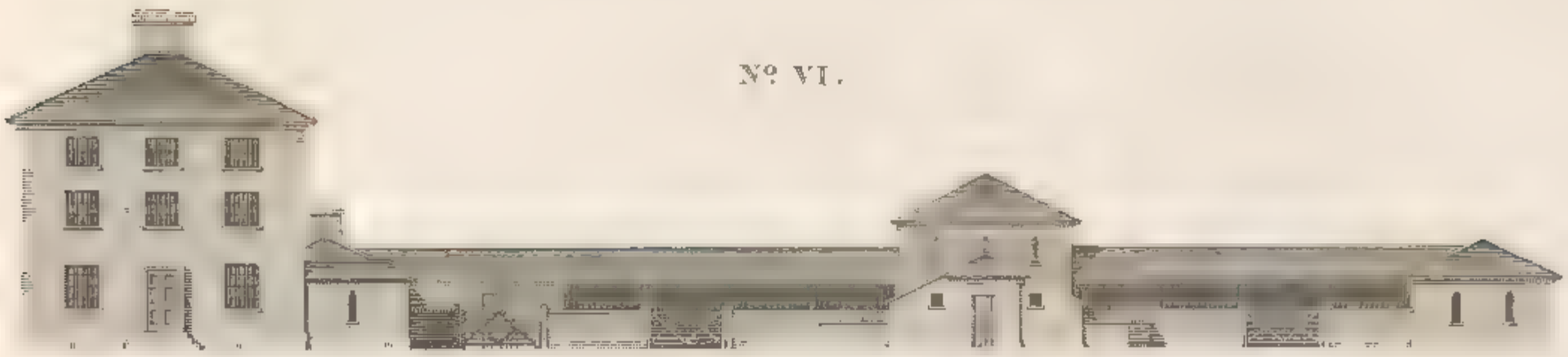
South Elevation



Engraved by W. Kelsall

FARM HOUSE AND OUT-BUILDINGS.

No VI.



South Elevation

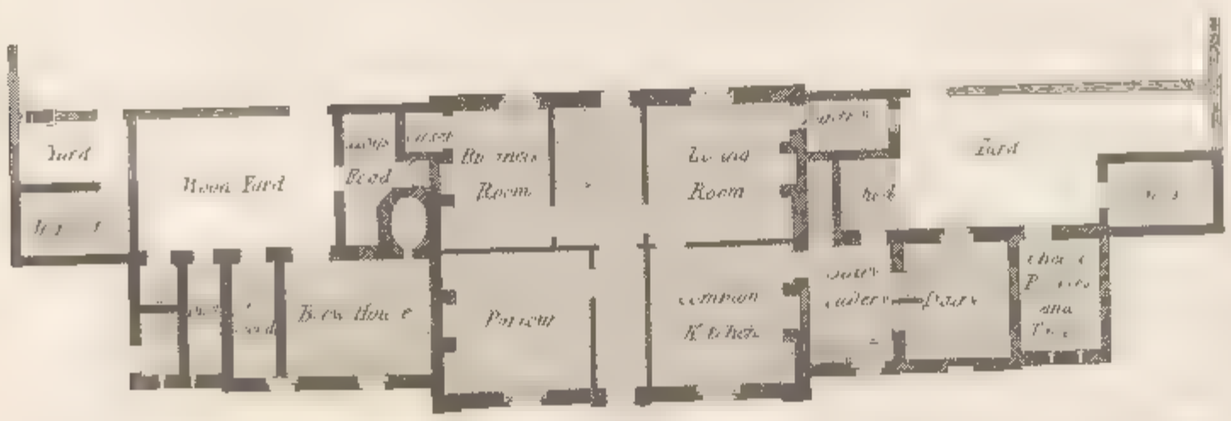
Ground Plan

Scale 16 to 1 Inch

FARM HOUSE AND OUT-BUILDINGS.

N° VII

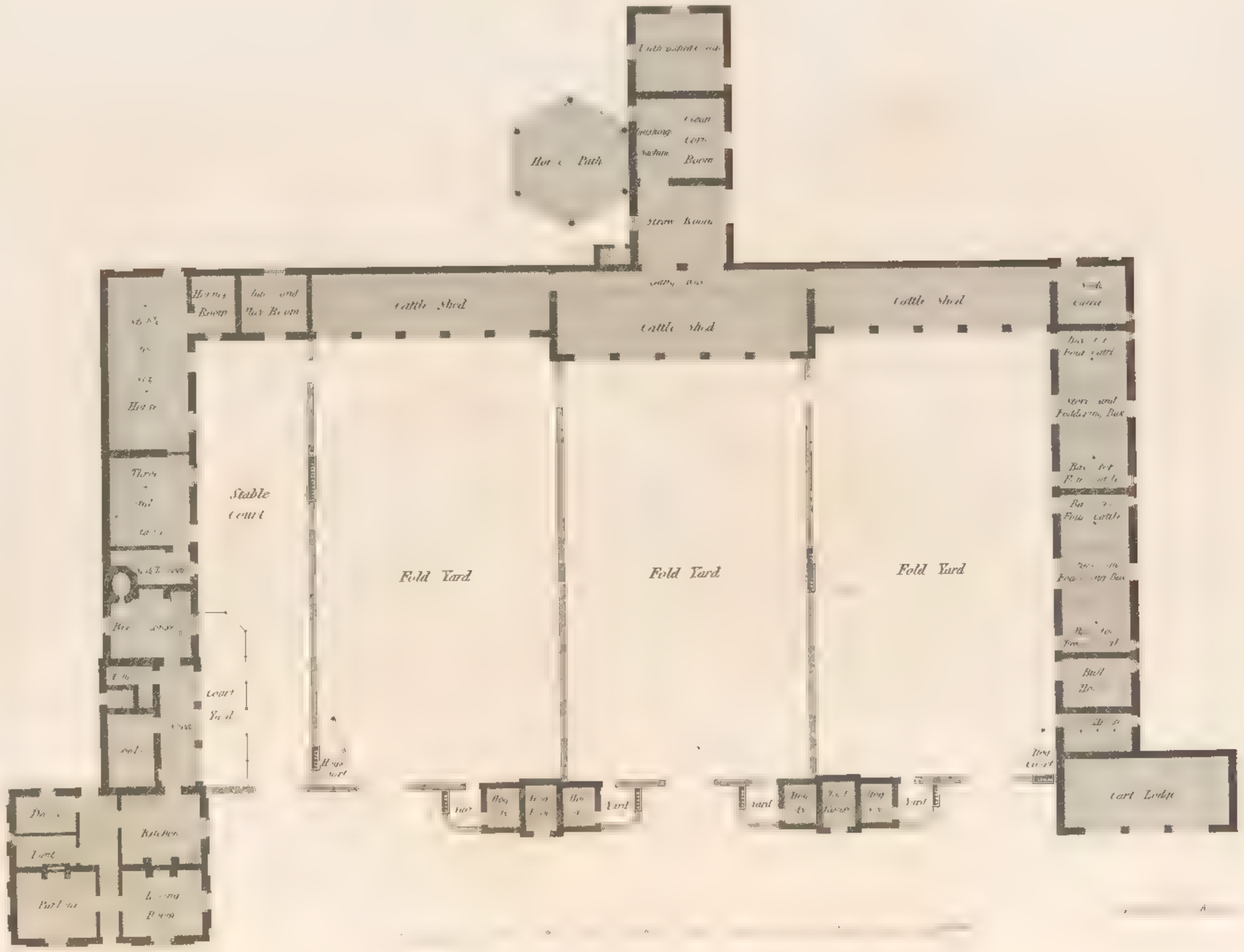
South Elevation



Engraved by W Edsall

FARM HOUSE AND OUT-BUILDINGS.

Nº VIII.



AN ISOMETRICAL PERSPECTIVE VIEW OF Nº VIII.

FARM HOUSE AND OUT-BUILDINGS.

No IX.

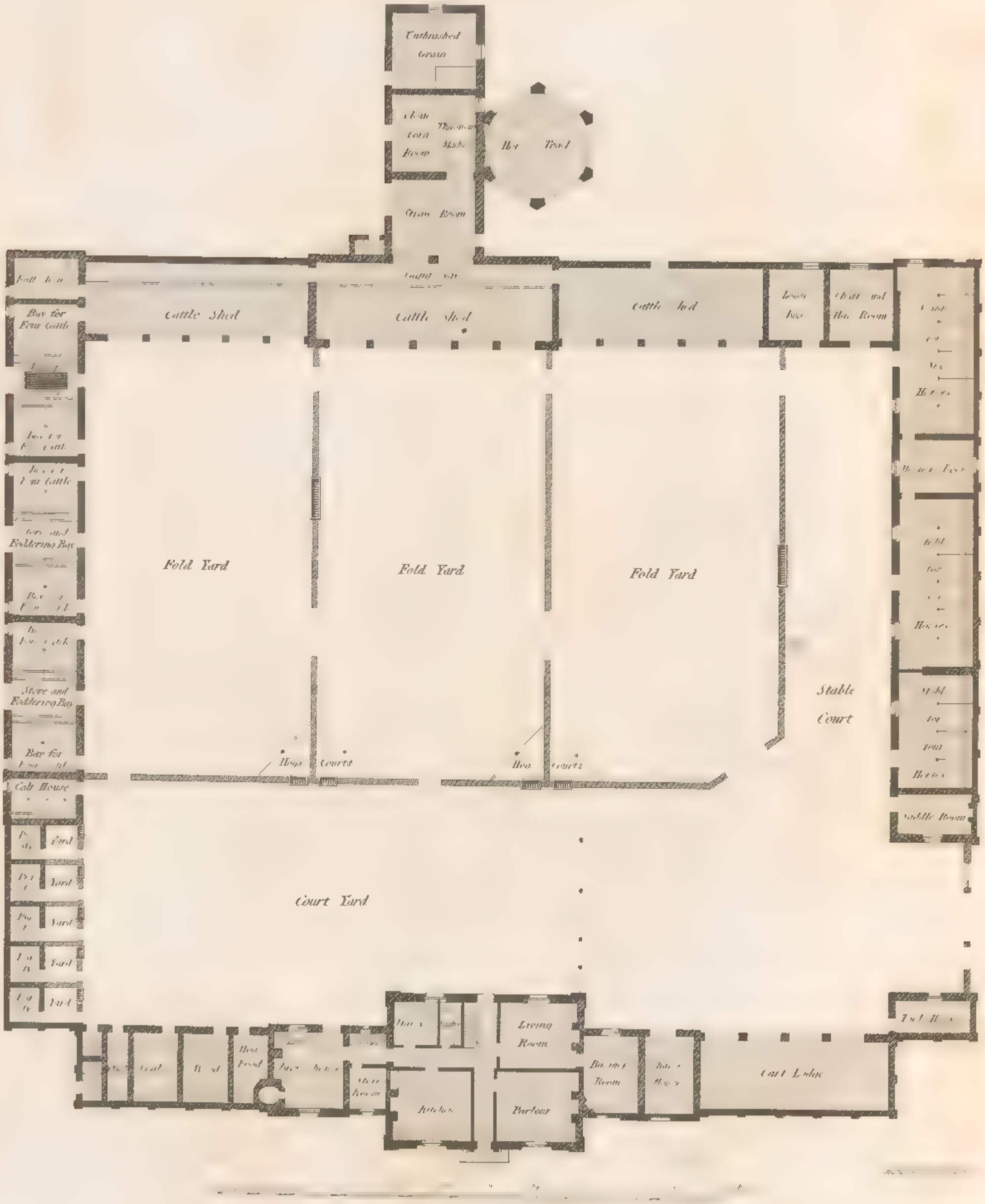
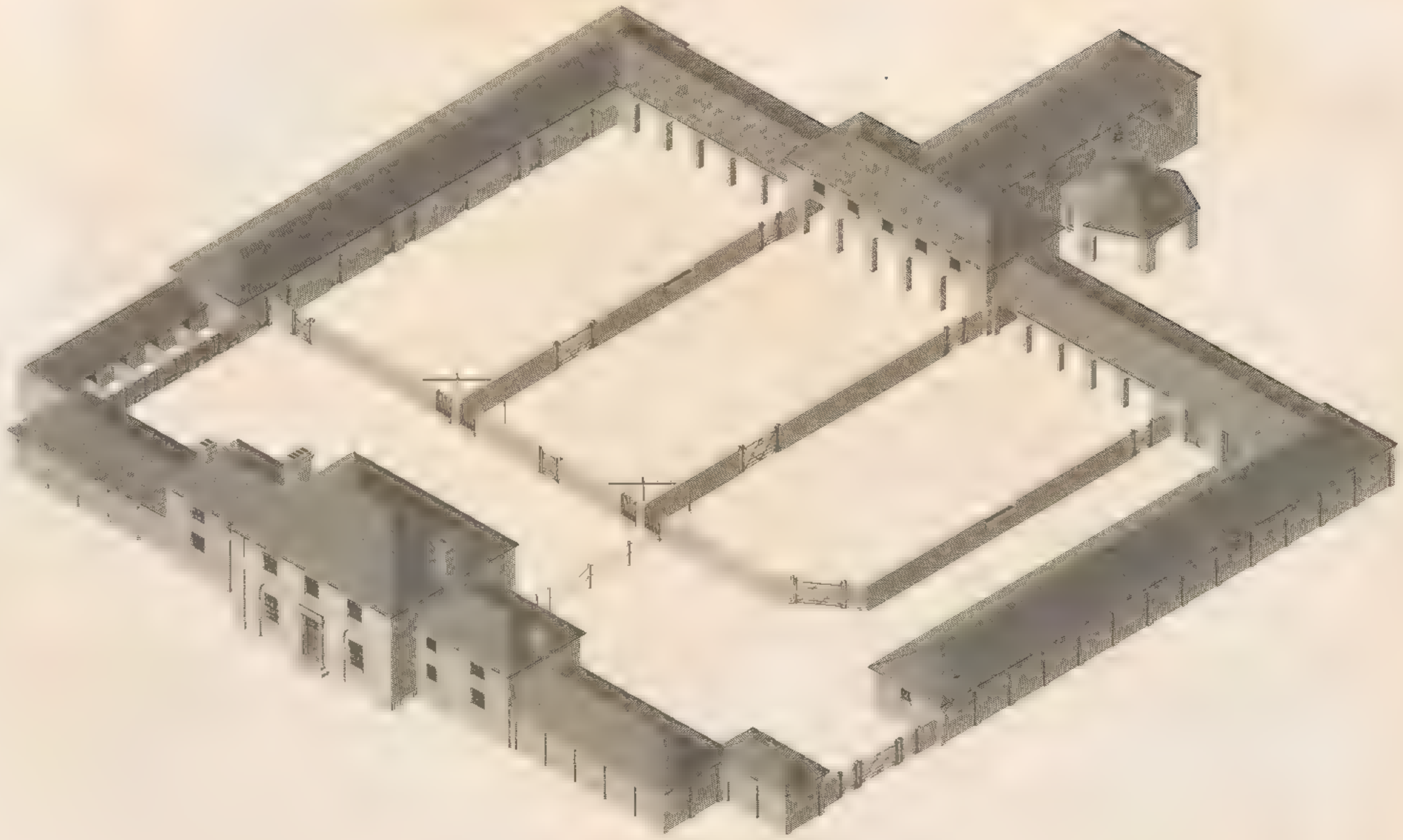


PLATE X

An Isometrical Perspective View of Nº IX.

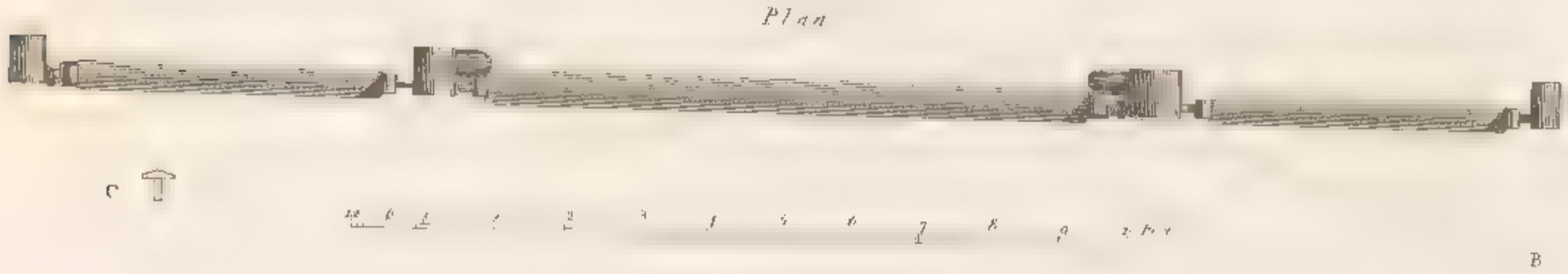


IMPROVED FIELD GATE.

Pl. 2.

A

Plan

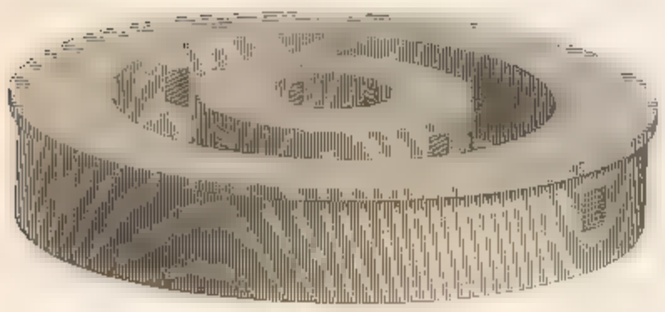


C

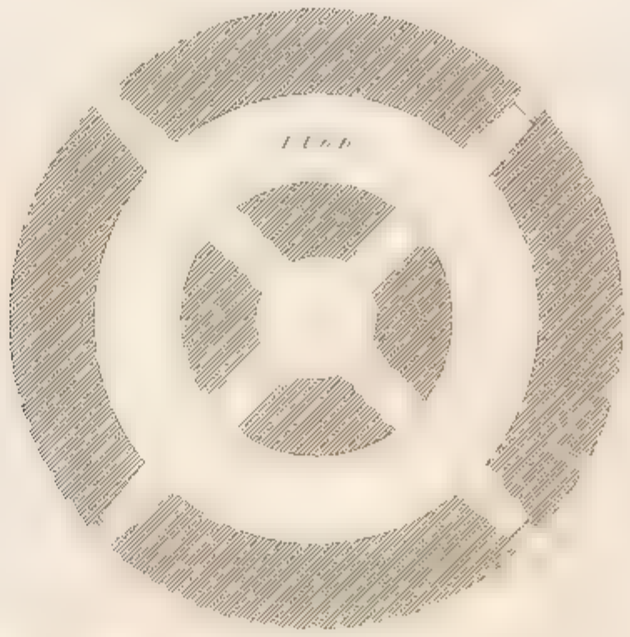
B

CORN-RICK STAND.

Perspective View



Plan

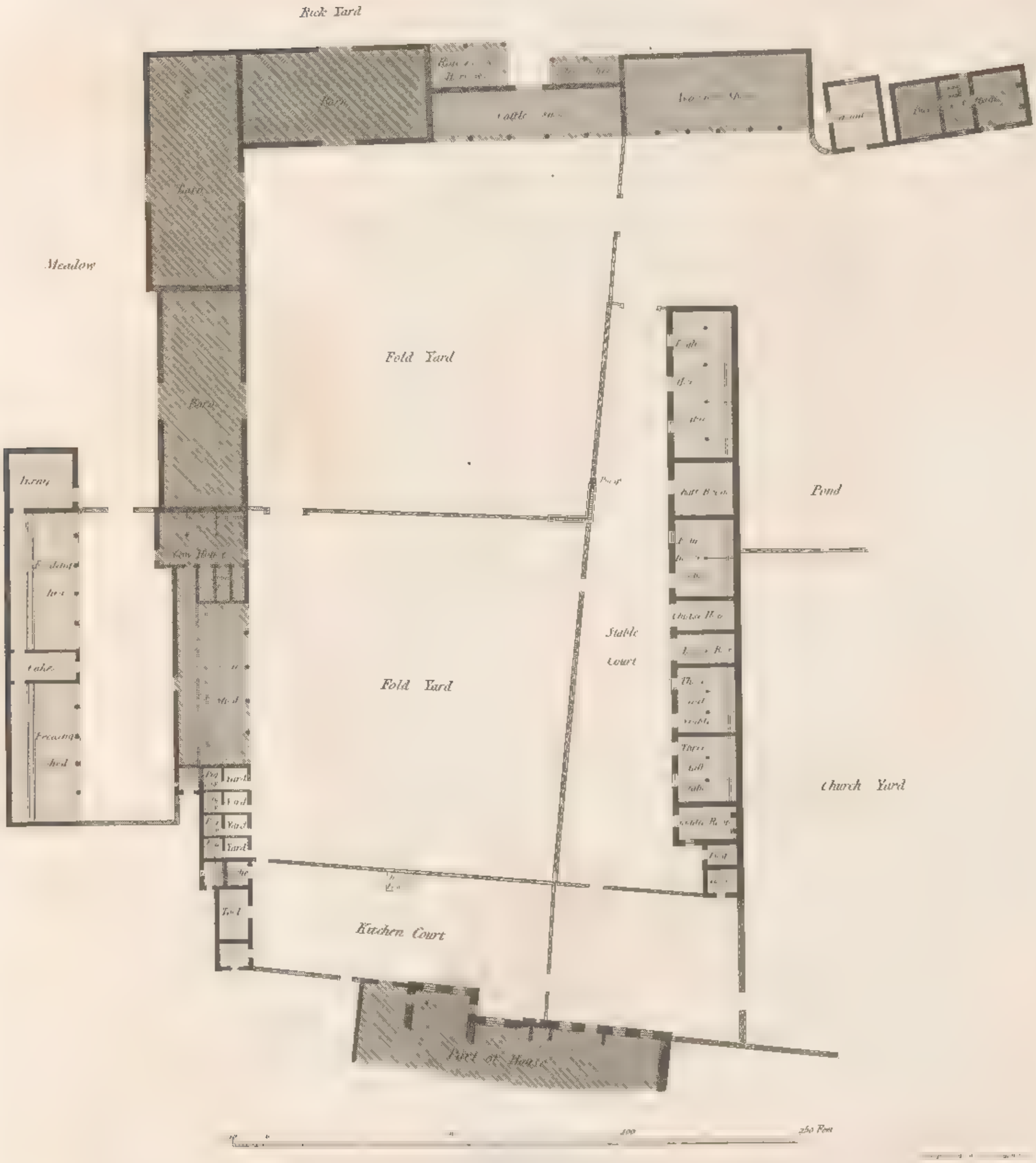


Pl. X.

PLAN OF CATERHAM FARM-YARD AS IT WAS.

PLAN

PLAN OF CATERHAM FARM-YARD IMPROVED



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